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Abolishing Utility Commissions

WHEN a candidate for governor can be nominated or almost nominated as was the case in Illinois on a platform of home rule for public utilities and the abolition of the State Public Utilities Commission it is time for the electrical industry to indulge in some introspection, even though a well-organized and financially oiled political machine in Chicago was mainly responsible for the large anti-commission vote. True, the utilities of Illinois managed to get along before the public utilities commissions were appointed and can probably do so again; but that does not explain the action of the people, who seem to be as much against the public utilities as they are against the regulatory commission. It is evident that there is still a lot of educational work to be done before every one shall appreciate the interdependence of the utilities and the public. There is nothing discouraging about the situation, however, if public utilities will take the lesson to heart and get busy on campaigns of public information. Their policy should be such as to bring the people and the commission closer to the companies, and that without much further delay.

Good-Will Campaign

REALIZING the gravity of the present financial situation and the necessity for higher rates if money is to flow into the electric light and power business, the National Electric Light Association has launched a good-will campaign on a very large scale. Of course, if the utilities are to obtain higher rates they must have the sympathetic understanding and good will of the public. To that end the campaign is designed to be informative, with the hope of awakening the public to the fact that its interests are identical with those of the industry. It augurs well for the movement that so far more than a million copies of the literature have been ordered; but to be effective every user of electric light and power in the country must be reached. This means that ten times that number of booklets must be disposed of. The present campaign should go over 100 per cent, and there can be no doubt as to the outcome if only the executives of electric light and power companies will do their part.

To Buy or Not to Buy?

MERE establishment of an interconnection between a steam station and a hydro-electric station by no means assures operation at maximum efficiency. Skillful handling of loads and equipment must be accomplished if the full benefits of such an arrangement are to be reaped. Where separate ownership or control is involved, the decision to buy or sell energy rests usually upon mutual convenience, and unless the operation of each plant tied into the line is managed with due regard to the conditions elsewhere, both fuel and water are liable to be wasted, to say nothing of labor. It is a great temptation for a steam plant to buy hydro-electric energy whenever it is advisable at surplus rates, but sight should not be lost of the effect of a material reduction in steam-plant load upon fuel economy. A careful inquiry into the relations between interconnected load distribution and station efficiency in every group of plants so tied together would be interesting.

Higher Rates Imperative

THE census of central electric light and power stations for 1917 reveals the startling fact that in that year there were 1,976 companies which paid no dividends whatsoever. While these were mostly small utilities, they comprise 67.8 per cent of the total number of incorporated central electric stations and 71 per cent of all which had outstanding capitalization. This certainly does not show a very healthy condition among the smaller utilities of the country, and it emphasizes anew the necessity for greater attention to their problems. It may be and probably is true that these smaller properties cannot be operated economically, yet nevertheless investments in even very economic stations have not proved lucrative. The rate of increase in revenues has been subject to a noticeable retardation during the past decade, and while the gross income has increased enormously the net income is constantly shrinking. Owing to the present high cost of coal and the increase in freight rates, the showing this year will probably be worse than ever. Further economies in generation and distribution are out of the question. The only way to keep the utilities solvent is by increases in rates, and those utilities which still delude themselves with the belief that they will be able to weather the storm should make haste to apply to commissions for immediate increases ere the psychological time has passed. It will be hard to face the public with increases in rates when all other living costs have begun to come down. The time for action is quickly passing.

Utilities Need Support of Business Men

INDUSTRY demands more electric power. To generate it would cost individual manufacturers far more than it would cost the central stations. The central stations, however, cannot supply the demand in full because of lack of capital. Capital cannot be raised when rates are unprofitable. Therefore industry must consent to higher charges. These are the steps in the chain of logic by which John Milton McMillin in this issue of the ELECTRICAL WORLD seeks to show manufacturers how vitally their interests are intertwined with those of the electrical supply companies. Quite rightly, he does not stop there. He contends also that the industries served by the central stations should them-

selves help to finance the companies from which they buy their power. In this way they will assure themselves of an uninterrupted and plentiful supply of a commodity as essential to them as machinery or raw materials, while at the same time they will encourage the electrical companies in redoubled effort. The idea can be carried further still. The commercial prosperity of a manufacturing town depends on the prosperity of the factories, so that the bankers, the merchants and all the citizens have a personal object in keeping the power supply adequate to the community's needs. Willingness to pay what the service is worth and a practical exhibition of confidence in the company's securities will save the day in many a community. It is the old story of self-interest told in a different way, with the appeal emphasized by the serious shortage of electric power that is threatened in the industrial centers of the land.

Productive Illumination

RECENT experiments have forcibly shown the importance of high intensities of illumination in increasing production. The ordinary and generally approved standards, as expressed in the various codes, may often fail to do this, and the reason for the failure is admirably explained by D. H. Tuck in this issue. It has long been known that there is a real physiological basis for proper illumination and that the intensity required in any case is a simple inverse function of the coefficient of reflection of the work, but the fact is quite too often neglected. It will, we hope, be better appreciated after a perusal of Mr. Tuck's article, which is reinforced by very practical examples. The industrial lighting codes implicitly recognize the situation, although they are hampered by being based on the safety and comfort of the workman alone, rather than on the full development of his productive powers. In other words, he may get along without serious danger of ocular trouble with somewhat less illumination than is necessary for working to the best advantage. If really efficient lighting were demanded the figures would be somewhat startling to the uninitiated.

As Mr. Tuck shows, working on black goods may require nearly 40 foot-candles in order to bring the eye really up to par, but usually only a small fraction of this value has been supplied even under this severe condition. The result has recently been shown in England by the occurrence of "miner's mystagomus" among seamstresses working on black goods. Another fact which has been disclosed by experiment is that in work where quickness of perception is required the amount of illumination must be very materially increased, suggesting that Fechner's fraction is larger in case of a hurried glance than for steady vision. Consequently any work which requires quickness of vision needs increased illumination. How far the difference is psychological rather than physiological remains yet to be determined, but it certainly exists. The moral of all this is that the illuminating engineer should not trust too implicitly to the mere readings of a foot-candle meter at the work as compared with code requirements, but should make a careful study of the character of that work and increase the lighting accordingly. If he will figure the cost of extra illumination, it will generally be surprisingly low when the output is taken into consideration.

Cost of Steam Plant Maintenance

IN AN editorial of last week's issue in which reference was made to an analysis of maintenance costs in steam generating stations an unfortunate combination of typographical error and ambiguous statement appeared in the statement on average cost of repairs to boilers and stokers and to electrical equipment over two years. Instead of this being 1½ cents per kilowatt-hour for boilers and stokers alone, it should have read $1.50 per kilovolt-ampere of average station rating for a two-year period, as noted at the top of page 614 in the article under discussion. Translated into kilowatt-hours output, the maintenance cost of boilers and stokers was 0.051 cent per kilowatt-hour for the period of 1918 to 1920 as compared with 0.083 cent for all repairs to steam equipment and 0.092 cent per kilowatt-hour for the total of steam and electrical repairs. It is interesting to note that the maintenance charges referred to are for a station having a rating of more than 60,000 kva. with the major part of the boiler and turbine equipment installed in 1918 and some of it from five to six years before that date. Compared with the average steam and electric plant repair costs (0.087 cent per kilowatt-hour) of seven other stations similar as to age and location, the unit costs referred to seem typical for plants of the size and character of load considered.

Reconnecting Induction Motors

WE TAKE pleasure in publishing, this week, with a full working chart to accompany it, a valuable paper by A. C. Roe, completing his instructions for reconnecting induction motors, which he began in our issue of July 24. The present paper deals specifically with two-phase motors as the previous one did with three-phase, covering precisely the same ground, that of furnishing to the practical winder precise data for reconnecting induction motors for a different number of poles or a different voltage from the original design. The description of the use of the charts is so simple and to the point that the armature winder should have no substantial difficulty in carrying out the instructions and producing within its possible limits the desired result. The scope of the charts is for a reconnection of from two to twelve poles for motors containing initially from 12 to 240 coils. Not all combinations are feasible either with two-phase or three-phase design and where such is the case or where coils must be "killed" the situation is plainly shown on the charts.

The only place where the winder not familiar with details of design may go wrong is in trying changes which are intrinsically bad considering the actual motor in hand—a situation which no charts can disclose. For instance, it is broadly true that extreme multipolar winding in small motors with a moderate number of coils is almost always productive of very bad power factor and frequently bad efficiency as well. The pole surface connected for four poles so as to produce a motor of excellent running qualities is likely to be altogether insufficient with twelve poles leading to a much less desirable configuration of magnetic circuit, and the same is true of extreme changes in the other direction, in which case neither the copper nor the iron is utilized to the best possible effect.

There may be instances in which a change of speed will be beneficial, but if attempts are made to adapt machines to other conditions than those for which they were designed dissatisfaction may result. Years ago a series of induction motors was put on the market made, so to speak, by piling together a long cylinder of toothed laminas of uniform diameter and then cutting off for an armature such length as seemed necessary for the required output. The result was that one of the series was an admirable motor with very advantageous distribution of iron and copper in the poles. Those with armatures longer or shorter were relatively poor, one or two of them very poor indeed.

In general, reconnection can be done very well with most motors for changes either in speed or voltage in no greater ratio than two to one. Sometimes in particular machines this ratio can be considerably extended without great disadvantage. More often there will be trouble with power factor and efficiency. So the electrician should go rather cautiously and judiciously into anything but rather simple changes. Within this limitation one may actually come out somewhat better at the finish than at the start, since a somewhat extreme multipolar design with long and narrow equivalent pole surfaces may be actually improved by reconnecting for a higher speed. The better the original design the more likelihood of damaging the performance by change of winding.

In all events these admirable charts and instructions of Mr. Roe put in the hands of the constructor or repairer information heretofore hardly to be found outside the designer's notebook and will undoubtedly enable many a motor to be reconnected and put to excellent service.

Organizing Maintenance on a Production Basis

MAINTENANCE work is nothing more or less than a permanent contract to keep equipment in first-class operating condition. The obligation is none the less pressing because of the fact that it is supposedly secondary to the business of producing power. The central station has been rather inclined to slight the general organization because of this fact of apparent secondary importance. As a result the general scheme of carrying out repair work has been somewhat inefficient. The Philadelphia Electric Company has, however, by working out a centralized system for maintenance, developed a method whereby this class of work is placed more nearly on a production basis. As shown by W. C. L. Eglin and F. C. Ralston in our last issue, such a plan accomplishes three main purposes: (1) The separation of all the details of maintaining plant equipment from those of its operation; (2) the establishment of uniform standards and methods of maintenance and inspection; (3) the development of specialists in the work of overhauling and repairing plant equipment.

From the results of more than five years' experience with this plan it has been demonstrated that a centralized maintenance section can handle the work efficiently and at a low cost. Another and one of the most commendable features is that the plan can be enlarged by simple expansion to any degree required by the growth of the system it serves, adhering to the fundamental principles upon which it is built.

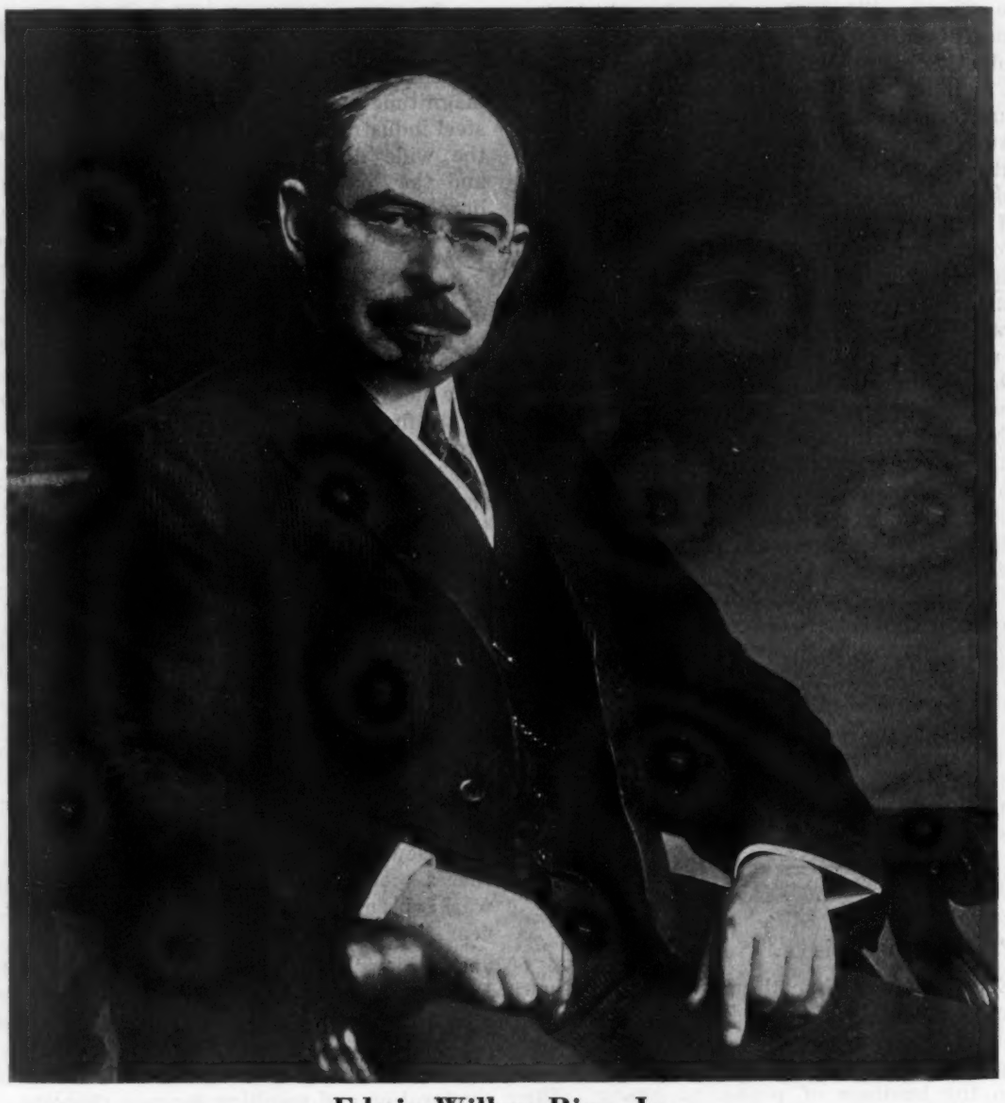
Electrifying the Steel Mill

A PERUSAL of the report of the Association of Iron and Steel Electrical Engineers, which is presented quite fully in this issue, brings a realization of the magnitude of the work of the electrical engineer in the steel industry. In particular, one is forced to appreciate the wide difference between this special application and the somewhat standardized engineering of older branches of electrical work. This is nowhere better emphasized than in a paper which was presented by K. A. Pauly and is abstracted in this issue and which deals with the electrically driven reversing mill. The question which faces the producer of rolled steel is that of ultimate cost, and for the electrically driven mill to prove its superiority it must meet requirements of economy not in mere power cost but in the manufacture of the finished steel. This, in the last analysis, turns on production, or the question of the tonnage that can be put through the works. Mr. Pauly forcefully points out that electric drive has successfully endured this crucial test.

From the standpoint of electrical equipment the vital factor is the speed at which the successive passes can be kept up. In the final consideration this again is a question of acceleration and of the average speed which can be reached hour in and hour out in rolling the ingots. Incidentally the reliability of the equipment, its staying in service and doing its work all the time determine the portion of working hours in the year during which this speed can be maintained. It is interesting to note that the electric motor has made good in this particular way in steel-mill practice as it has elsewhere. It seems to be the universal experience that a motor-driven machine will stay on the job and work at full output more of the working hours per year than any of its competitors.

Considering the rolling-mill motor in particular, Mr. Pauly shows in some very instructive curves the effect of increased input on increased speed of making the pass. It is, on the whole, surprisingly great, the increase in permissible input paying richly in increased acceleration and resulting tonnage capacity. It is right here that modern American practice has departed widely from the earlier standards so far as there were any. At first the question was whether the electric motor could be made to stand the speed and torque requirements. That question having been answered, the one which now arises is how hard service in this particular the motor will stand. The limit has certainly not yet been reached and yet the performance of a steam-driven mill has been clearly passed.

There has been a considerable variation from early practice. The shunt motor has replaced the earlier compound-wound machine; the auxiliary generators have been built with laminated fields to quicken their response to the control, and all the control mechanism has been speeded up. The result is that the production has been increased accordingly. The electric motor of today is a very different machine from that which was somewhat timidly pushing into the field of general power. Experience in the steel industry shows very plainly that it is not only able to hold its own in continuous service of the most severe character but that it is capable of efforts that bring tonnage output to a new production level. In short, the electric motor is the most facile and convenient drive.



Edwin Wilbur Rice, Jr.

Pioneer, inventor, engineer—for thirty-five years a master mind in molding the engineering development of the industry

BEGINNING his active technical work forty years ago and having been director of the engineering development of the largest electrical manufacturing company in the United States since its inception thirty years ago, E. W. Rice, Jr., has had a very large share in molding the progress of the electrical industry. His faith in the future of the tungsten lamp when its filament was so frail as to make it almost impracticable gave rise to the investigation which resulted in the rugged lamp of today. The larger development both electrically and mechanically of the polyphase motor is coupled with his name. His recognition of the weak point in high-voltage polyphase-current distribution led to a switching system both safe and simple. To his broad view of engineering needs also is due in large measure the present system of alternating-current distribution and its subsequent conversion into direct current through rotary converters. Besides this, he has been to a great extent instrumental in furthering the development of the steam turbine and has followed this field very closely, even in the past few years, in an effort to secure for the electric light and power industry the last degree of plant economy. It was under his direction that the adoption and subsequent development of the Curtis turbine by the General Electric Company took place. Mr. Rice, himself an inventor with more than 100 patents to his credit, has an enviable capacity for encouraging and leading the inventive ability of his subordinates. It is not too much to say that the research laboratory of the General Electric Company—unique in its relation to industrial and advanced scientific progress and well known throughout the world—owed its inception and later development in a high degree to his realization of the value of such an organization.

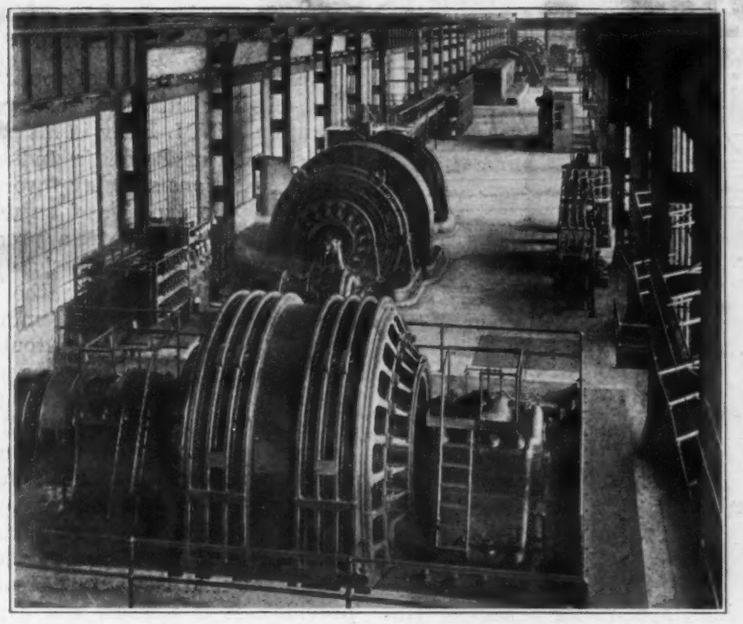
Mr. Rice came into the industry in 1880 upon his graduation from the Philadelphia Central High School as the assistant and confidant of Prof. Elihu Thomson, who had just formed the American Electric Company at New Britain, Conn. When this property was moved to Lynn, Mass., and renamed the Thomson-Houston Electric Company, young Rice was permitted to engage in the work he liked best under the man for whom he had the greatest admiration—experimentation and invention with Professor Thomson. In three years a works superintendent was needed and, not without regret, Mr. Rice accepted this position. As the work expanded and the field grew he grew also, and when this company was consolidated in 1892 with the Edison interests to form the General Electric Company he became technical director of the new company. Four years later he was made a vice-president, and when in 1913 C. A. Coffin retired from the presidency Mr. Rice succeeded him. He was born at La Crosse, Wis., May 6, 1862. In 1917-18 he was president of the A.I.E.E.

Application of Power in Steel Mills

Electric Reversing Mill Drive Compares Favorably with Steam Drive from Tonnage Standpoint—Factors Which Enter Into the Choice Between Overhead and Underground Transmission Systems

APPLICATION of power from the plant to the drive, together with related subjects of education of electricians and standardization of equipment, were specially considered at the fourteenth annual convention of the Association of Iron and Steel Electrical Engineers, held in New York Sept. 20 to Sept. 25.

From the standpoint of production the electric mill has many advantages over the steam mill, chief among which is the extremely small loss due to delays caused by the drive, and because of this an electric mill of the same hourly capacity will exceed the steam mill in monthly or yearly capacity, K. A. Pauly, General Electric Company, asserted in his paper on "The Electric Reversing Mill Considered from the Standpoint of Tonnage." However, the task of the electric mill is not an easy one, since the handicap which it has compared with its competitor (due to the higher moment of inertia of moving parts) must not be overlooked. The results obtained with motor drive, however, compare very favorably with modern steam reversing engines under similar conditions, as shown by the time curves for an electric driven Trumbull mill and a modern steam mill. It will be noted that it is approximately one second after the steel enters the steam mill before the engine has again the speed at which it was running when the steel entered, while with the electric mill there is no drop whatsoever. It is in this respect that the shunt-wound differs from the compound-wound mill motor, the latter dropping its speed as the steel enters, although not to so great an extent as the steam engine. These curves are selected to illustrate the speed characteristics of the two types of drives rather than to indicate record speeds for tonnage.



ELECTRIFICATION OF MILL DRIVES HAS DEVELOPED A PROBLEM OF FIRST MAGNITUDE IN THE STEEL INDUSTRY THAT THE ELECTRICAL ENGINEER IS RAPIDLY SOLVING

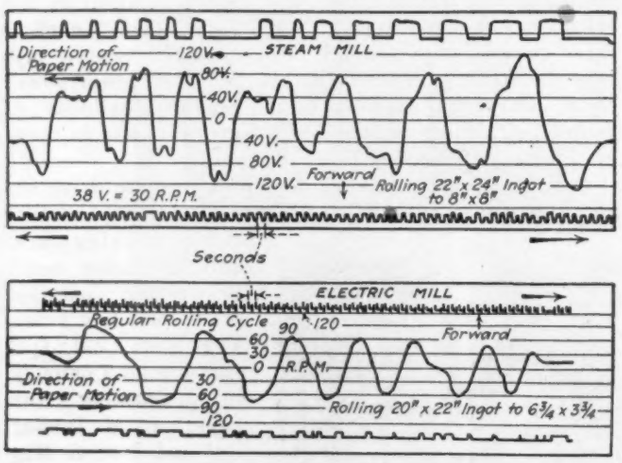
There is, of course, a limit to the capacity of any drive, and the characteristics of electric equipment are such that unless some automatic means is provided for limiting the power of the roll motors a careless operator cannot use the electrical equipment. Current-limit controls have been developed for this purpose, their function being to limit the current taken, and therefore the maximum power developed by the roll motors, to a value which they and their generator can safely carry at frequent intervals. The current-limit setting for the main roll motors therefore is a real indication of the relative peak-load capacity for rolling steel. Coupling these records with the advantages of the electric mill over the steam mill from the standpoint of lower power costs, lower maintenance costs, greater flexibility of control, etc., there is little room for arguments in favor of the steam reversing mill.

Aside from tonnage considerations, electric drive has an important relation to labor conditions, because cleaner working places and less noise result in better satisfied crews, said J. E. Fries, Tennessee Coal, Iron & Railroad Company, in discussing this paper. R. M. Dudley, Ashland Iron & Mining Company, stated that since there is a maximum roll pressure which can be applied to a billet, the procedure in obtaining high tonnages from electric drives is to establish the drive torque required and then lay out the motor installation with this limit in view. As a blooming mill costs approximately $2,000,000 at present prices it would seem that quibbling over about $40,000 in added material in electrical equipment is rather trivial, especially when the effect on tonnage is so great. D. M. Petty, Bethlehem Steel Company, pointed out the advisability of spare parts for quick repair of mill drives. Current values, E. H. Wentz, National Tube Company, held, should be set on the basis of tonnage requirements, thus saving wear and tear on machines and consuming less energy per ton of steel rolled.

Auxiliary Drives as Important from Standpoint of Interruptions as Main Drive

Among the factors influencing the selection and application of motors and control presented by Gordon Fox, of American Steel & Tube Company, were useful work, friction load and inertia. A motor size may be tentatively selected which will cover the work and friction loads and have sufficient margin to handle the inertia load. For a running drive the work and friction load may well comprise 75 to 80 per cent of the motor rating. For a start-stop drive the work and friction loads may be permitted to require about 40 to 60 per cent. Having selected a motor drive, speeds may next be considered. For a running drive the full running speed is the consideration of importance. For a start-stop drive

the ability to accelerate, decelerate, reverse or spot the machine is ordinarily of primary import. For any set of conditions a definite gear ratio exists which will minimize the inertia load and permit most rapid acceleration or deceleration with an available amount of motor torque. To determine this ratio Mr. Stratton



THESE SPEED-TIME CURVES SHOW THE RELATION BETWEEN A STEAM AND AN ELECTRIC DRIVEN MILL

The steam mill, having less inertia of parts, accelerates more quickly but slows down as the billet enters the mill. The motor, however, shows no slackening of speed on this account.

developed the following formula in the *A. I. E. E. Proceedings* of 1915:

$$r = \sqrt{\frac{I_1}{I_2} + \frac{(FR)^2}{T^2}} \pm \frac{FR}{T}$$

In this formula

r = most favorable gear ratio between armature shaft and given shaft of machine.

I_1 = moment of inertia of machine at given shaft.

I_2 = moment of inertia of motor armature (including pinion, coupling or brake wheel) at armature shaft.

FR = torque at given shaft required to overcome combined friction and work loads.

T = motor torque available during the accelerating period at motor shaft.

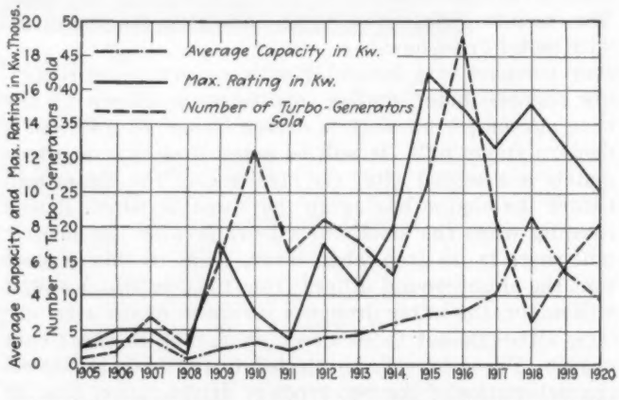
The item $\pm FR/T$ may be omitted if a drive is to be considered in which acceleration and deceleration are of equal importance. When quick acceleration is most desirable the item $+ FR/T$ should be used. For drives where quick stop is desired the item $- FR/T$ should be inserted. Having selected a gear ratio, it is possible to determine the rate at which the machine may be either brought up to speed or stopped. The calculations are based upon the premise that the torques demanded by friction and work loads are practically constant. Variation in torque demand during the cycle, however, may lead to decided variations in speed. In using variable speed motors it is desirable that counterweighting or other means be employed to balance the torque demand as far as possible, since this relieves the motor of unecessary work. Concerning compound-wound mill-type motors, a motor having a no-load speed not to exceed 150 per cent of full-load speed will meet in the most satisfactory manner the requirements of the majority of these drives. Appendices attached to Mr. Fox's paper gave the derivation of formulas suggested for use in this work. Two examples show the application of methods and the formulas to a mill-table drive.

In discussing this paper W. C. Kennedy stated that it would seem advisable to draw time-distance curves using several gear ratios on the auxiliary drive rather than to substitute in a mathematical formula. The lagre open-type low-speed motor for auxiliary drives is an abomination in the steel industry, declared J. E. Fries. The consideration is the accelerating rather than the ultimate speed. A smaller, higher-speed motor with a larger gear ratio is preferable since the lower inertia in the armature makes acceleration more rapid.

Two main points must be considered in choosing motor sizes, A. W. Deenham observed: (1) Does the machine have sufficient peak capacity to start the load quickly? and (2) is the continuous capacity sufficient to carry the duty cycle continuously?

MANY FACTORS IN SELECTION OF POWER DISTRIBUTION SYSTEMS

Next to the question of application of drives the question of distribution of energy received considerable attention. D. M. Petty in his paper, "Transmission and Distribution of Power in Industrial Plants," said that unless conditions are very favorable it is rather difficult to justify the expense of an underground distribution system as compared to a properly laid-out overhead system using all the various schemes available for insuring good service to the producing department. While the underground system has some valuable advantages, such as eliminating trouble due to lightning and interference from outside agencies, removing certain hazards to workmen about the plant, still the overhead system, if properly laid out, will effect these advantages and will allow in some ways more flexibility than the underground system. In a duct system the size of conductors is limited not only by handling facilities but on account of heating. As a rule a fault in one phase will disable all three phases and is not easy to repair. Unless the load is well anticipated and extra ducts are provided, it is difficult and expensive to increase the capacity of the system. The overhead transmission


Average Capacity in Kw.
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Number of Turbo-Generators Sold
Average Capacity and Max. Rating in Kw. Thous.
Number of Turbo-Generators Sold
0 2 4 6 8 10 12 14 16 18 20
0 5 10 15 20 25 30 35 40 45 50
1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920

GROWTH OF STEEL MILL POWER IS INDICATED BY THESE CURVES SHOWING THE CAPACITY INSTALLED YEARLY

system not only costs much less than underground systems, but it is easy to increase capacity when the occasion demands, and by using care in selecting the location of towers and supports many of the disadvantages can be reduced to a very low minimum. By using at least two grounded so-called "static wires" above those carrying the power, and by placing lightning arresters at each tapping-off point, or even more often on long lines and at very vital load centers, damage by lightning can be reduced to an almost negligible quantity. By using

properly designed guards, ladders and platforms the hazard to workmen may be reduced to a very low point.

As an important factor in the laying out of a transmission system is the effect of its operation on the cost of the finished product, the question of continuity of service to the consuming unit may be fully as important as the cost per kilowatt-hour, and is far more important than the cost of transmitting power to any other producing unit. Provision should be made to isolate any part of the transmission system on which trouble occurs without seriously disturbing the load on any other part. This may be done automatically or manually, depending on the importance of the load. Mr. Petty considered a number of lay-outs, such as radial feeders, and loop feeders. The first division may be further divided into bus feeders, also known as the tree system, and individual feeders. The tree system, as its name indicates, may have several branches which carry power to load centers and may consist of a single line of relatively large capacity or of more than one line operating in parallel. In this case the two lines can be operated in parallel or independently, and any of the branch circuits may be connected to either line. In the system of loop feeding there are several arrangements, one which is considered very good being known as the ring bus.* The author has also considered the question of line efficiency as related to the cost of a distribution system and has gone into a comparison of central station and industrial distribution.

Split or balance-phase protection does not work out so well if there is trouble on two phases or in the station because the current transformers are in the split phase, declared R. B. Gerhardt, Bethlehem Steel Company, in the discussion of this paper. However, attention was called by Mr. Petty to the fact that the ring-bus system allowed only five tap-off substations as a maximum.

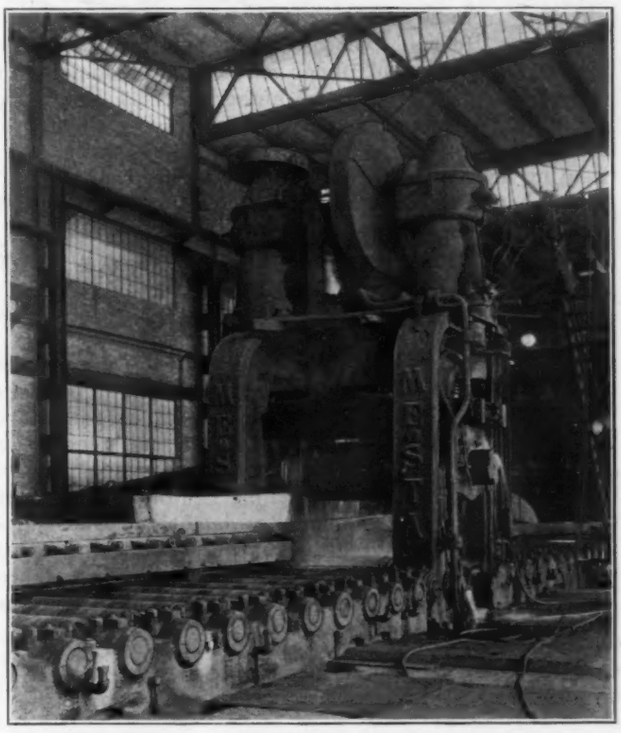
COMPARISON OF THREE METHODS OF LAYING OUT UNDERGROUND TRANSMISSION

There are three main methods for installing underground conductors for distribution around a steel plant —namely, in a tunnel, in ducts or by burying directly in the earth—A. L. Freret, Tennessee Coal, Iron & Railroad Company, said in his paper on "Underground Transmission." The underground tunnel has advantages over the two other methods for comparatively short distances, where the cables are connecting heavy and very important loads, and where it makes a convenient passage from station to station. Better ventilation, accessibility of conductors, which allows frequent inspection, and ample space for the installation of cables are the chief points of superiority of a tunnel installation. The initial cost, however, is sometimes prohibitive.

In choosing the duct to be used for an underground system of this class it is very important to provide ducts large enough to take care of the largest cable. Some engineers recommend using a duct ½ in. (1.25 cm.) larger than the outer diameter of the cable, but in the event of using many cables of different size it would seem advisable to choose a size of duct which would accommodate the largest size of cable which might be used. In this way in laying out spare conduits any cable could be used that might be required.

There is some difference of opinion in regard to the number of ducts which should be used in one group, but, according to Mr. Freret, twelve or fourteen should be the maximum and if more are required they should be divided into two groups with earth between. Vitrified duct has many characteristics which make it less desirable for distribution systems, he said, than that which is made from fiber. For example, duct of the vitrified class has many joints on account of the short sections, which make it harder to line up properly and is more liable to leakage. Besides, the inside of the duct is apt to have burrs which will injure the lead casing of the cable and the material requires careful handling to prevent breakage. Vitrified duct will also melt under short circuits, sometimes causing injury to other cables or so destroying the duct as to render it unfit for use again unless very expensive repairs are made. Concrete ducts have the greatest arc-resisting qualities.

In the layout of a system the manholes are next in importance to the ducts themselves. Concrete manholes seem preferable to brick, being cheaper to build and easier to waterproof. They should be of sufficient size to permit laying the cables along the side walls and to facilitate drawing in, splicing, etc., but should not be so large as to cause too sharp and pronounced bends in the cable when leading it from the duct to the wall.



BLOOMING MILLS OF THIS TYPE WITH ELECTRIC DRIVE ARE TURNING OUT TONNAGES COMPARABLE WITH STEAM EQUIPMENT

The author also took up a discussion of insulation for cables, and the conclusion is reached that for plants where continuity of service is important varnished cambric is by far the best insulation for cables and the cheapest for underground work in the long run.

In considering paper-insulated and varnished-cambric-insulated cables the external heat conditions are important, James Farrington, La Belle Iron Works, said, and in case of high external temperatures paper is the better material. Barriers between cables in tunnels are important to localize cable troubles, Albert Hovey, Standard Underground Cable Company, added.

*The double-ring bus system of the Bethlehem Steel Company's plant at Sparrows Point, Md., was described by R. B. Gerhardt in the July 24 issue of the ELECTRICAL WORLD.

T. E. Keating, Westinghouse Electric & Manufacturing Company, presented some of the specific points to be considered in the economic design of a power plant for a steel mill by assuming a hypothetical case and working out the solution. In discussing this paper Gordon Fox, American Steel & Tube Company, stated that as the load on steel plants varied sometimes 4,000 kw. or 5,000 kw. in less than a minute a margin above the regular working steam pressure should be carried in order to take care of these sudden overloads. He said that his company had installed duplicate equipment to take care of the operations which absolutely had to proceed to keep the mill running in case of breakdown of the regular equipment. Walter C. Kennedy concurred with Mr. Fox that several plants should be constructed around the different parts of the mill in order to make use of the waste heat generated in the different locations. Benjamin J. Fernald, Kerr Turbine Company, said that he thought the fixed charges as stated in Mr. Keating's paper were too low and that they would probably run from 20 to 30 per cent, with an average of 25 per cent. He said the cost of money should average about 15 per cent and 10 per cent should be allowed for depreciation. Coal was also higher than $5, the figure given by Mr. Keating, and when insurance is added to this the total cost would be about 25 per cent. Mr. Keating agreed that they might be higher than allowed in his paper, but said that he believed they should not be over 20 per cent.

The processes in a steel plant are of such a nature that delay at any one point in the progression is usually felt all along the line, R. H. Keil asserted in his paper on "Current Limiting Reactance."

Since interruptions to the power supply are just as serious, while they last, as any other delay, it becomes imperative to do everything within reason to assure continuity in the supply of power. Spare generating equipment, double feeders to all important substations, and duplicate buses and switching equipment help, but none of them limits the amount of damage done to equipment during short circuits or other electrical failures either in degree or extent. For this purpose reactance coils have been found very effective in central stations and in some steel-mill power houses.

NEED FOR EDUCATIONAL COURSES FELT IN TRAINING OF STEEL-MILL ELECTRICIANS

Realizing the pressing need of some means of cutting down mill delays and of getting inspectors and operators on the job who can efficiently handle and make repairs to electrical equipment, the educational committee is preparing a textbook and suggests that the electrical superintendent of each steel mill start a class of about twelve men in a six weeks' course of practical instruction in the operation, maintenance and theory of the electrical equipment in their plants. A suggested division by weeks of such a course was as follows:

First Week.—Motors: Types; assembling; relation of poles; interpoles and connections; brush setting; bearings; connections.

Second Week.—Manual Controllers: Types; repairs to segments; repairs to fingers; adjustment of fingers; pressure required; familiarity with connections and spare parts.

Third Week.—Automatic Controllers: Contactors; operation, adjustments; contacts; wiring; overloads; relays; spare parts.

Fourth Week.—Brakes: Types; windings; setting; operation; adjustments; connections and spares.

Fifth Week.—Magnets: Operator's controller; magnet assembling; resistance connections; operation and installation.

Sixth Week.—General: Inspection and repairs to all kinds of electrical apparatus; importance of keeping equipment clean; ordering spare parts.

NECESSITY FOR STANDARDIZING MOTORS, CRANES, CONTROLS AND LIGHTING

Sub-committees of the standardization committee, W. T. Snyder, National Tube Company, chairman, brought suggestions for discussion before the convention for standardizing motors, cranes, control and lighting equipment. Requests for suggestions for standardizing direct-current mill-type motors and induction motors were made by the motor sub-committee, of which D. M. Petty is chairman.

For maintenance where direct-lighting systems are used the committee suggested a schedule showing intervals of cleaning (in days) as follows:

Characteristic of Location	If Units Are Wiped Out*	If Units Are Thoroughly Washed
Very dirty	3	5
Dirty	7	10
Average	15	20
Clean	30	40

*Washing every third or fourth interval assumed.

Discussing standardization of cranes, E. S. Lammers, National Tube Company, chairman of this sub-committee, said that from the viewpoint of duty the various crane ratings now employed in steel-mill practice could be boiled down to a small group of standards that would meet the requirements of all usual crane appliances and eliminate further arbitrary selections. As a whole the committee did not lay stress on standard trolley spans except as a matter of refinement. The greatest need of all is a standard bearing for the different-size shafts. This alone would accomplish much toward reducing the burden and cost of maintenance. The builders now agree on the type, but owing to the lack of co-operation differ on the detail. In conclusion the committee recommended that the steel-mill members of the association and the crane builders be invited to become active members of the Crane Standardization Club of the association, each member to send one official representative, or more, to a monthly meeting for the purpose of discussing and adopting crane standards.

That standardization be continued during the coming year on the simpler forms of magnetic-type controller for cranes and hoists and also for general mill-table service was suggested by F. J. Burd, Cambria Steel Company, chairman of the sub-committee on control standardization. Some of the requirements common to direct-current 220-volt forms of magnetic control, as applied to cranes, mill tables and general reversing service, proposed by the committee as standard were: Control to break both sides of the main circuit every time the motor is cut off the lines; overload relays with electrical reset to be used in both main lines; the number of accelerating points to be as follows: Up to 25 hp., 3 points; up to 75 hp., 4 points; up to 150 hp., 5 points.

Regarding illumination the sub-committee on this subject, Ward Harrison, National Lamp Works, chairman, stated that in conjunction with the bowl-enameled lamp the R. L. M. standard-dome reflector provides a lighting equipment that will meet most requirements of the steel industry.

Industrial Support for Central Stations

In a Message to Business Men They Are Asked to Advocate Higher Rates and Also to Furnish Capital—Demands for Power Reaching Emergency Stage—Isolated Plants Are Far More Costly than Purchased Energy

By JOHN MILTON McMILLIN
Assistant Manager Bond Department Henry L. Doherty & Company

A HEAD-ON collision has occurred between the rising rental charge for new capital and the regulations which govern "the reasonable rate of return" which capital may earn in a public utility. This condition is of far-reaching effect and has not yet produced all of the complications that it may, but manufacturers who depend largely upon electric power are already beginning to feel it.

How is an electric central station going to continue making plant extensions with capital costing from 10 to 15 per cent net when the public service regulations often assume that about 8 per cent, plus an allowance for depreciation, is the limit which the new capital should be permitted to earn? Who will put up the money and services without the hope of gain, and what has the power company to gain even if it now has the money? How far can the power company go in building extensions out of the reinvestment of its earnings if there is legally required about ten dollars of capital to bring 80 cents of annual net earnings for interest and dividends? Where is the manufacturer going to come out who now, to keep up with his own growth, expects to get increased service from a central power station which has already been fully loaded by the mad scramble for power the last few years in nearly all manufacturing centers? What other solution for this condition can there be than that the power user shall furnish this new capital and also exert his influence toward permitting higher rates for electric service?

Help in answering these questions can only be expected when the users of electric service become better acquainted with some angles of the electric power business which ordinarily are not understood by the general public. However much we may hope that part of the difficulties are only temporary, something must be done now. Already the increasing demands for electric service in certain manufacturing centers have practically reached a condition of emergency.

Central-Station Power by Far the Cheapest

The cost of adequate power cannot be avoided through manufacturers building their own individual plants. There are very many other reasons why this is true in addition to the matter of the bare dollars of original cost. For one thing, the production of power is a specialty which can best be handled by specialists who give their lives to that sole subject. Again, the power station has to be located where it can obtain adequate condensing water, whereas the manufacturer might much better locate his factory at the best site from the point of view of railway facilities and the convenient housing of employees. The production of power in large quantities reduces the cost per unit just as in the production of anything else. In spite of advancing electric rates, there is a greater amount of stability in the public service power item than in almost any other element of cost with which a manufacturer has to reckon.

The big outstanding fact of the case, however, is that the community as a whole and the manufacturers as individuals can obtain power facilities for less capital outlay, in addition to lower operating costs, by working through the central station than by any other means. This is true even if they furnish the whole amount of capital required to enlarge the capacity of the public utility plant. The power load of ten manufacturers each of whom requires 1,000 kw. can be carried by a smaller central station than an aggregate of individual power plants. This is because the central station will only have to reckon with the average load, whereas each individual plant would have to be large enough to carry the maximum, and even then would have no reserve capacity. Still further savings in capital requirements are made possible by the lessened cost of the larger generating machines per unit of capacity. In round figures, the necessary capital to furnish the power requirements of a manufacturer is more than cut in two by having the additional capacity installed in the plant of the public service company. Similar savings in operating economies in the central power station have brought the usual power charges of a public service company down very much below what a manufacturer would have to spend to generate the same power in his own isolated plant, even if he could get the coal. In round figures, this item also is approximately cut in half. Public service regulations require that these charges be reasonable.

Difficulties of the Public Utilities

The most puzzling question in the mind of the average business man is why the public utility companies are so often seen in difficulties trying to raise new capital. He is puzzled to observe it even when earning statements show that a company is making an apparent success. Some light ought to be thrown on that subject at once. One reason is that while the biggest single item of necessary capital in a manufacturing enterprise is usually a talent for trade, the biggest single item of capital required in the electric power business is cash. Another reason is that while the average business man is permitted to earn all he can without any regard to the amount of cash invested in his business, a public utility company, under most of the laws and the spirit of all of them, is permitted only to make net earnings which are definitely measured by the dollars invested in the cost of establishing the business, with the further stipulation that this rate of return shall be very moderate indeed.

Supposing that a public service corporation is permitted to establish rates which will produce net earnings from its operations equivalent to an 8 per cent return on the capital invested in the business, how much is there going to be left for plant extensions after paying even the most moderate dividends and pre-war

interest charges? It must be obvious to any practical man that if such a company were earning $800,000 per annum it might require $10,000,000 of new capital to double the business, and there have been instances recently where the very great demands for electric power have required the doubling of the plant facilities of an electric central station in a year.

Normally, there is a dependable source of a fairly uniform and continuous supply of new capital for such purposes. It is available through the requirements of conservative investors who place part of their savings in the public service business, and further augmented by the investment requirements of banks, insurance companies, estates, etc. These buyers are satisfied with the moderate rate of return afforded by such securities because they recognize the protection afforded their capital through the public service laws and regulations. These regulations, while they do permit only a moderate rate of return, nevertheless usually make that small return more dependably secure than is the case in many other lines of business. But when credit conditions tighten up and investors cease buying securities these sources of new capital vanish and public service plant construction must come to a dead stop. The earnings of the company are wholly inadequate as a rule to finance any appreciable part of capital requirements of a rapidly growing public utility company.

There has been a marked falling off in the amount of investment funds for public utilities during the present year, and during the last six months there has been only the most meager supply of it in comparison with the pressing demands for public utility plant extensions. The owners and operators of such properties in many cases thought at first that this condition would be temporary, but soon found that they could not go on very far through borrowing capital from bankers and others on short-time arrangements. The volume of credit available for such purposes early became an almost negligible factor. Where construction was continued it therefore had to be paid for out of cash reserves. Obviously this last remedy could not be used indefinitely. Thus it has come about that power-plant construction has had to be greatly curtailed for the simple and practical reason that it could not be continued, however much the operators might have believed it to be sound business to go on with the work.

WHAT CAN BE DONE ABOUT IT?

Now, how can the man who wants to do something about it help to mend this condition? For one thing he must right about face in regard to his attitude on rates for electric service. Niggardliness on the part of many communities has effectually prevented public service corporations from establishing rates high enough even to produce net earnings equivalent to the meager allowance permitted under public service laws and regulations. Many a public service manager who knows that the earnings of his property are only a half or a third of even the "reasonable rate of return" on the valuation of the property and the business dares not attempt the establishment of the increase in rates necessary to correct this condition. He has been discouraged by the grievous experiences he has heretofore had in collisions with popular ideas of right rates.

Happily this condition is by no means universal. There are communities where a much more broad-minded consideration is given to rate problems. But under the best of conditions the usual attitude is merely a willingness to let the public utility live, not a willingness to see it prosper, and even where this is true your average business man takes rather a passive interest in the situation. He must take a militant attitude.

HOW THE BUSINESS MEN'S HELP WILL TELL

The aggressive help of business men will very quickly make a great deal of difference. The public service company is naturally the biggest optimist in a town. It has to be, for its investment is absolutely anchored there. Its only hope for the future is the future of the community. It will take heart and find hope with less encouragement than any other business enterprise in the town. Finding itself backed up in a prospective rate increase by the aggressive and militant friendship of the majority of business men, it will generally find some way to manage its affairs so that the growth of the community and its industries need not be retarded for a lack of adequate public service.

Increased rates, however generous, will only solve the problem in part, for to the investor's mind this will merely correct past errors. New capital must be found for enlargements of plant facilities, and plans to find it should be laid right now, for boilers and turbines cannot be supplied in thirty days after the need becomes insistent. The next thing the business man must therefore prepare himself to do is to advance out of his own funds a substantial portion, if not all, of the cost of plant extensions required to handle his increasing business. He can reduce the burden which he will thus have to assume by a prompt and vigorous spirit of co-operation with the public service company in the effort to establish rates for service sufficient to encourage the bondholders and stockholders whose money is already invested.

In providing these advances short-term loans will not solve the problem. A number of power companies have joined with their customers in that temporary expedient during the last few months; but so far as the public service companies are concerned this has been a makeshift and not a policy. Help to finance new extensions on any great scale will very likely have to be obtained through investment in longer-term securities than have heretofore been considered. Very likely it will be a matter of ten-year bonds, or it may have to be managed through preferred-stock subscriptions. An advantage in the latter would lie in the fact that the purchase of junior securities would assist in the sale of bonds to general investors.

Encouragement of the expansion of railway facilities was withheld until the natural inevitable result was congestion of appalling proportions. The present railway capacity now limits commerce like the neck of a bottle. Will practical business men, with that lesson before them, permit a similar result in electric power capacity? Unlike the railroad problem, which required a national willingness to face it, the public utility situation in each individual case can be discussed and acted upon by just the small percentage of citizens in any community who usually mold its public opinion.

The two simple expedients suggested, prompt advances in rates and financial assistance from customers, are both entirely practical. In many manufacturing communities whose industries are growing a panic demand for electric power within the next twelve months is the only apparent alternative.

Features of 37,500-Hp. Water Turbines*

Not Being Handicapped by Competitive Bidding, the Manufacturers of the 35,000-Hp. Niagara Falls Wheels Have Incorporated Ideas Therein That Assure Maximum Reliability and Efficient Operation

THE new 100,000-hp. extension to the plant of the Niagara Falls Power Company, which was considered from the general engineering viewpoint in previous contributions by J. L. Harper, G. R. Shepard, N. R. Gibson and L. S. Bernstein, contains the most powerful hydraulic turbines ever built. Two were furnished by the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company and one by the Allis-Chalmers Manufacturing Company. As pointed out before, the contracts for these wheels were not placed on a basis of competitive bids, but general dimensions, external appearance, paralleling characteristics and general excellence were specified.

Water Wheel and Generator Considered as Homogeneous Unit

Speed Ring Integral Part of Foundation—Cast-Iron Pit Liner—Guide-Vane Wear Minimized—Governor Is Very Steady and Positive—Hydraucone Regainer Employed

By W. M. White

Manager and Chief Engineer Hydraulic Department Allis-Chalmers Manufacturing Company

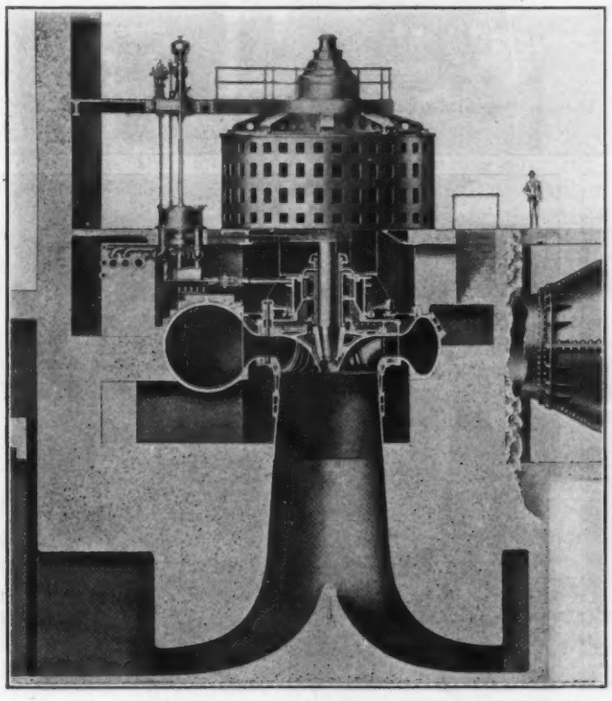
SINCE the design of the entire Allis-Chalmers hydroelectric unit was under the control of a single group of engineers, it was possible to consider the structure properly as a homogeneous unit and correctly to proportion and correlate the various elements. Its most striking features are the form of casing, governor, interconnecting barrel, brake support and draft tube.

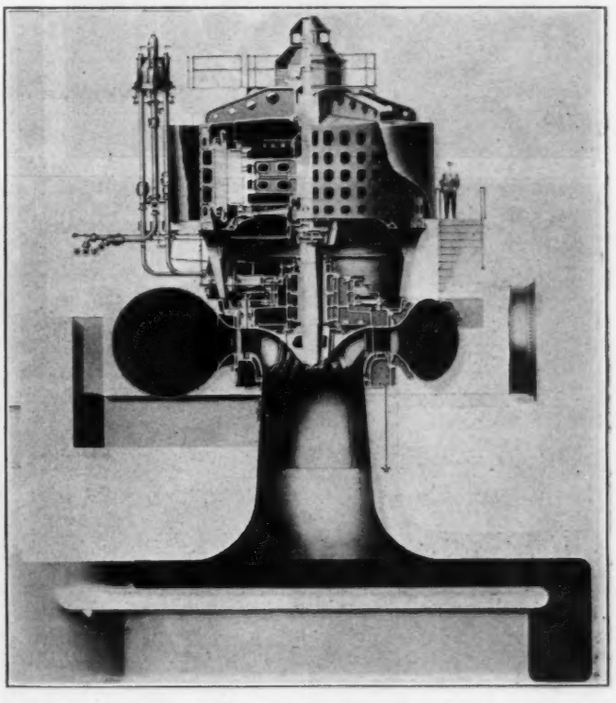
The casing is made up of a multiplicity of conical sections of plate steel of gradually reducing cross-sectional area around the turbine. The plates are riveted to the flanges of a cast-steel speed ring, which forms an integral part of the casing and the foundation of the turbine parts.

Water from the casing to the runner is controlled by means of twenty cast-steel guide vanes. Each vane is operated by a lever through a link attached to the shifting ring on the outside of the turbine and is held in position by two thrust bearings, one supporting the weight and the other resisting the upward hydraulic thrust when the unit is in operation. The thrust bearings are so adjusted that the guide vane is held in a central position between the distributer plates; consequently there is no wear between the ends of the vanes and the distributer plates. Around each vane stem is a stuffing box to prevent water from flowing through the bronze bearings supporting the vane—a specially desirable feature in that silt and sand, which would tend rapidly to wear the main supporting journal, are not carried between the surfaces by leakage. The vane stems are attached to the shifting ring through links so proportioned as to fail before a guide vane or its stem is strained beyond its elastic limit.

The runner is made of gray iron in one casting and is bolted to a cast-iron hub which is keyed to the tapered

*Second installment of a symposium on the 100,000 hp. extension to Station No. 3 of the Niagara Falls Power Company, see Sept. 18, 1920, issue of the ELECTRICAL WORLD.





FIGS. 1 AND 2—TWO NEW 37,500-HP. UNITS OF THE NIAGARA FALLS POWER COMPANY

The units were built by different manufacturers (left, I. P. Morris wheel and Westinghouse generator; right, Allis-Chalmers unit) under the same general specifications. Generators are rated at 32,500 kva., 12,000 volts, and the units operate at 150 r.p.m. under 214-ft. head. Two types of draft tubes are shown—the spreading draft tube and hydraucone.

end of the turbine shaft. The turbine guide bearing consists of lignum vitæ fitted into cast-iron blocks having the end grain of the lignum vitæ toward the shaft. The bearing of this unit is 5 ft. (1.5 m.) in length and is made in two portions for convenience in dismantling and ease of handling. The bearing is lubricated by water supplied from the headrace through fine strainers. Connection is also made to the city mains for use of filtered water during times when headrace water contains considerable silt and sand.

A feature of design peculiar to this unit is the cast-iron pit liner forming the turbine pit and transmitting the weight of the generator through this pit liner directly to the speed ring and through the vanes of the speed ring to the foundation. Interalignment of the generator, turbine, etc., is thus permanently insured.

The guide vanes of the turbine are controlled by means of water pressure on two pistons connecting to opposite sides of the shifting ring. This arrangement keeps the governor pipes outside of the turbine chamber and enables the cover plate of the turbine to be removed without disturbing the cylinders and governor piping.

Another interesting feature of design is the governor equipment especially designed for this unit. The position of the stems on the guide vanes is such that the vanes will be in hydraulic balance when about one-third open. They will require considerable force to close or still further open the vanes from that point, but both forces are minimized. With a difference between the sides of the governor pistons equal to an operating pressure of 200 lb. (14 kg. per sq.cm.) and consequently by the usual method of rating governors, the governor of this unit has a capacity of 240,000 ft.-lb. (33,120 kg.-m.). The operating pressure to the cylinders is controlled by means of a four-ported piston valve in the governor stand. This valve is moved axially by varying the pressure on each end of its body by means of another four-ported piston valve, which in turn is moved by a pilot valve. With this arrangement the force exerted upon the flyball mechanism is not sufficient to prevent the flyballs taking up their exact position corresponding to the speed of the unit.

Direct-connected flyballs were used to secure steady, positive and as near frictionless operation as possible. The mechanism consists essentially of a fixed collar clamped around the main turbine shaft and a movable collar held in position and away from the shaft by four sets of ball-bearing toggle joints placed 90 deg. apart.

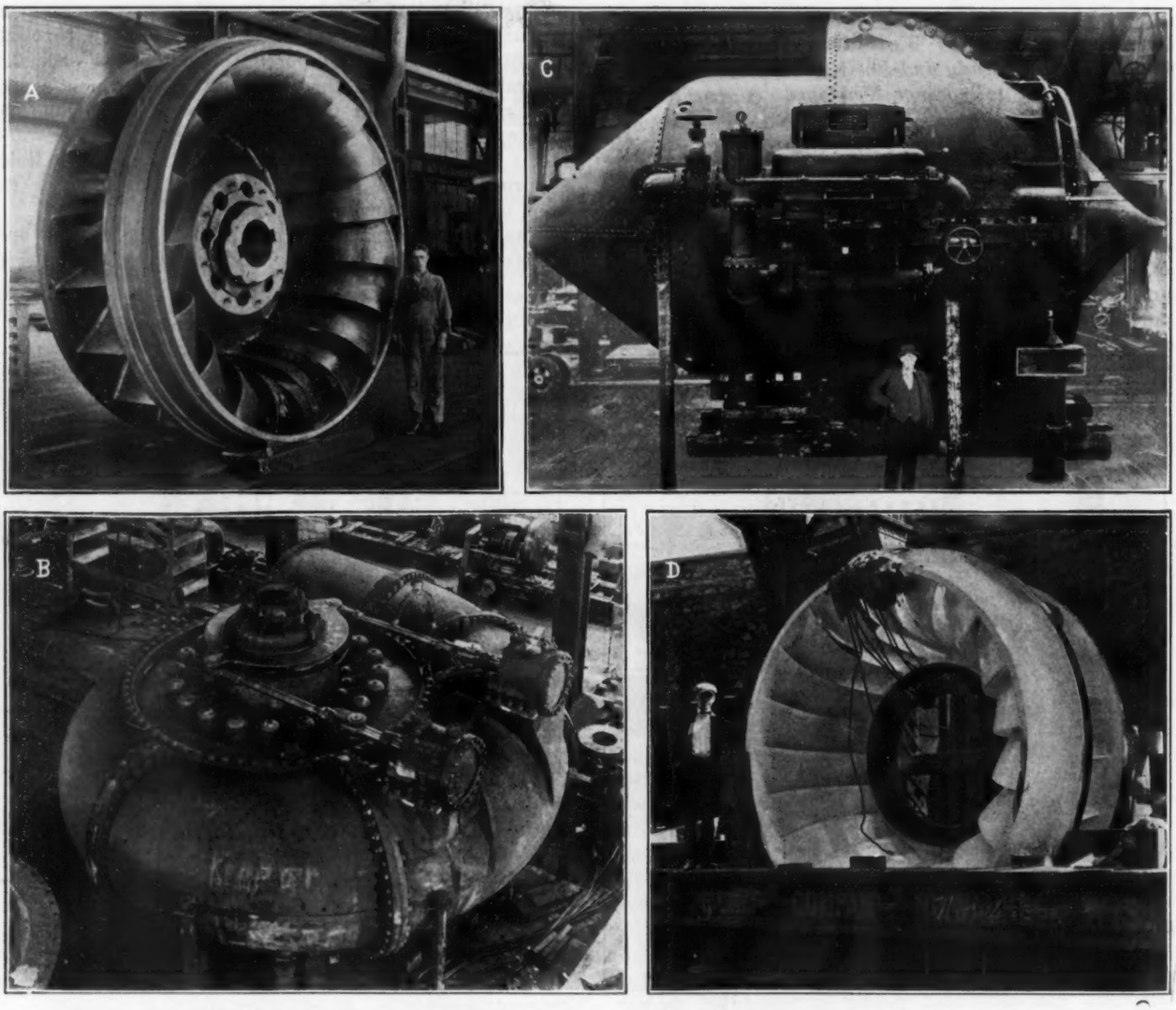


FIG. 5—REPRESENTATIVE VIEWS OF HYDRAULIC UNITS BEFORE ASSEMBLY

(A) and (B), runner and assembled unit of I. P. Morris construction. (C) Johnson valve for control of water in penstocks, and (D) Allis-Chalmers runner.

The governor has been adjusted to close the turbine gates from wide open to completely closed in three seconds of time and to open them from closed to wide-open position in four seconds of time. It is expected that the rise of speed with 40,000 hp. suddenly thrown off the unit will not exceed 25 per cent. The regulation of the unit and the normal load conditions are remarkably steady and positive.

One of the greatest losses in hydraulic turbines is in the energy discharged from the runner. Heretofore efforts have been made to utilize this energy by transforming the velocity into pressure for maintaining below the runner greater vacuum than would normally result from the elevation of the runner above tailwater level. In these units, however, the diameter of the runner is so large compared to the distance from the runner to the tailwater level that it was not feasible to design the draft tube in this manner. Consequently a hydraucone regainer was used. This is a chamber having the general form which the jet of water would take upon striking the impinging surface except that the capacity of the chamber is gradually greater in area in the direction of flow than that required to just close the hydraucone. The radially extending passage also affords a means of regaining for useful effect the whirl of the water as it leaves the runner at partial loads. It is not within the scope of this article to discuss at length the hydraucone, but a discussion of it will appear soon in one of the engineering journals.

Two Water Wheels for Generators of Different Make

Cast-Iron Casing Affords Smooth Contour, Resists Corrosion and Supports Unit—Load-Spreading Draft Tube Reduces Vibration and Improves Efficiency—Grease Gun for Lubrication

BY LEWIS F. MOODY
Assistant to Vice-President and Consulting Engineer William Cramp & Sons Ship & Engine Building Company

THE I. P. Morris turbines are of the vertical-shaft, single-runner type, having cast-iron volute casings embedded in the concrete of the power-house substructure. Particular care was taken to provide an efficient water passage at every point. Owing to the construction of the turbine casing of cast iron, it has been possible to preserve smooth surface contours for the internal surfaces of the casing and to avoid all local disturbances in the flow due to abrupt changes of direction or irregular surfaces. The casing is stayed across the distributer by a cast-steel speed ring, the vanes of which line up with alternate guide vanes when the latter are in the position corresponding to maximum efficiency. After passing through the runner, the water enters a straight conical draft tube of cast iron built in sections. From the lower end of the cast-iron section of draft tube the remainder of the tube is molded in the concrete substructure.

The draft tube is of a new type, the "spreading draft tube," the design of which has been carefully calculated and verified by many tests of experimental models both under conditions of smooth stream-line flow and under the actual conditions of flow experienced when the discharge is received from a runner. In the design of this tube it has been the object to turn the water as smoothly as possible along paths of gradual curvature from the vertical to the horizontal direction and to preserve symmetry about the turbine axis to a point where the velocity has been reduced to so low a value that only a small amount of velocity head remains in the water. Care has been taken to maintain a gradual decrease in the velocity by properly varying the transverse area of the passage at all points in the tube, in order under all conditions of operation to avoid the formation of eddies or disturbances which may cause severe vibration of the water column in the penstock and turbine.

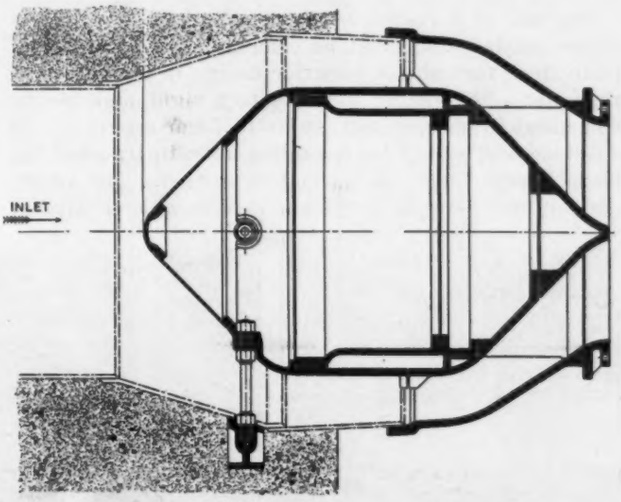


FIG. 4—LARGEST PENSTOCK VALVE IN WORLD

A Johnson hydraulic valve measuring 17 ft. x 24 ft. over all is installed at the bottom of each penstock close to the entrance to the wheel casing. The valves are balanced needle-type valves, having a movable plunger sliding in an internal cylinder. The plunger is of differential form, providing two operating chambers which are alternately exhausted to the air to move the plunger, the hydraulic pressure in the penstock furnishing the sole actuating force. Local or remote control can be used. The valve stroke may be set for any time up to a minimum of thirty seconds for a complete stroke in either direction. The valve can also be set to close automatically in case of a serious break in the wheel casing.

Another advantage of the form of tube used is the ability of such a draft tube to regain the energy of whirling components of velocity in the water leaving the runner. This property of the tube is of value in increasing the efficiency under part-gate and over-gate conditions and in increasing the margin of power beyond the point of maximum efficiency of the turbine. Preliminary tests of the turbine indicate that both advantages have been realized, and in actual operation the unit is remarkably free from vibration at all gate openings.

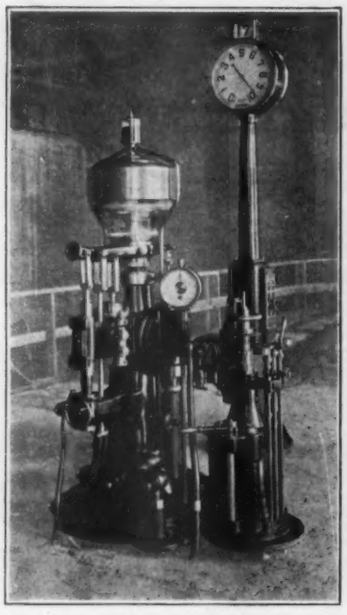
The turbine runners are of cast iron, each one being in one piece. The specific speed of the runners is 158 metric or 35.5 in the foot-pound system. At normal discharge the corrected velocity of the water leaving the runner and entering the draft tube is 21.3 ft. (6.4 m.) per second, corresponding to a velocity head of 7 ft. (2.1 m.), or 3.3 per cent of the effective head on the turbine.

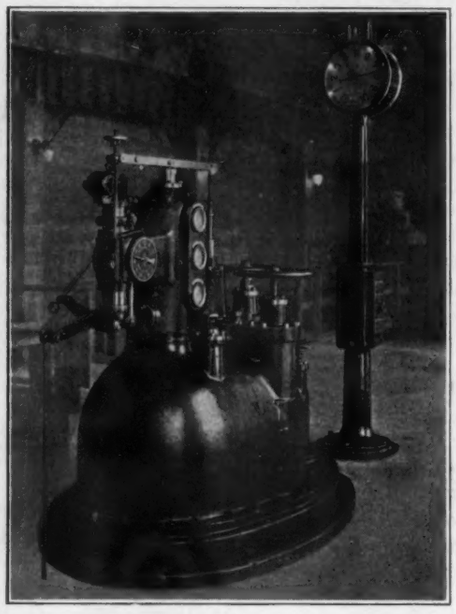
Although the most valuable feature of the new draft tube is probably the elimination of vibration just mentioned, it is also estimated that this tube will improve the efficiency over that which could be obtained with tubes containing elbows by from 0.3 per cent to 0.4 per cent in the efficiency of the entire turbine under conditions of normal gate operation. The same type of draft tube when applied to turbines of high specific speed would, of course, be capable of producing much

greater increases in efficiency than is possible in these turbines, which are of moderate specific speed. The final discharge velocity from the draft tube at normal gate is approximately 5 ft. (1.5 m.) per second, corresponding to a velocity head of 0.175 per cent of the effective head on the turbine.

MECHANICAL FEATURES

The use of a cast-iron casing, although involving a somewhat increased cost as compared with the use of plate steel, furnishes a superior design in the following respects: The casing is absolutely rigid and can be embedded in the concrete so as to form a part of the substructure, and it can be relied upon to transmit the loads imposed upon it without distortion. The resistance of cast iron to corrosion insures a long life for the casing. Furthermore, there is no likelihood of local points of weakness being developed. The casings were subjected to hydrostatic pressure tests in the shops up to 120 lb. per square inch, which is well in excess of any pressure to which the casings can be subjected in operation during a quick gate closure resulting in water hammer.





FIGS. 7 AND 8—GOVERNOR MECHANISM FOR I. P. MORRIS AND ALLIS-CHALMERS WHEELS

The levers and other parts of the vane-actuating mechanism are made sufficiently strong so that failure of any portion should be an unusual occurrence even when trash becomes lodged between two guide vanes and the entire governor power is concentrated on two vanes. Renewable breaking links are provided to protect the mechanism in case undue load should occur. The operating ring is supported on a ball bearing and is turned by two cylinders which are bolted to brackets cast on the turbine casing, thus making the entire operating mechanism self-contained with the turbine.

For the lubrication of the operating gear, the Taylor system of lubrication is used, consisting of a central grease gun supplying a system of piping leading to each individual bearing. Admission of grease or oil can be controlled to each bearing individually by turning a separate cock at each bearing, the lubricant being forced into the bearing by air pressure admitted to the grease gun. The grease gun consists of a vertical cylinder and piston which can be filled with grease or heavy oil below the piston and air from the powerhouse pressure system admitted above the piston.

To relieve thrust above and reduce leakage around the runner multiple or labyrinth runner seals are used consisting of a series of contractions interposed in the path of the leakage water, alternating with enlargements in which the velocity of the leakage flow produces eddies and reduces the quantity escaping. This provision, although affecting only a small percentage of the total energy when the turbine is new, will be of material advantage in preventing a serious deterioration in efficiency after the unit has been some time in operation. The leakage above the runner passes through a cored space in the turbine head cover and is vented through the runner hub, discharging into the center of the draft tube.

The main shaft of the turbine has a lignum-vitæ guide bearing in the turbine-head cover, the bearing shell being split both horizontally and vertically to facilitate its removal. Acting upon the lower face of the generator rotor are brakes consisting of a series of shoes actuated by air plungers. The operation of the brake is controlled from a cock on the hand-control stand.

In order to avoid running a number of large governor pipes from the operating cylinders up to the gallery, with a consequent increase in the length of fluid column between the governor and the cylinders, resulting in increased inertia of this fluid column, the main governor valves are separate from the governor and placed on the level of the generator-room floor so that they are immediately above the operating cylinders. The Taylor control system is used with these units. This involves the use of fluid-operated plunger valves of the Johnson type, by the operation of which the operating cylinders can be connected to either the governor or the hand-control system. All of the valves for shifting from governor to hand control and back again are controlled by a single lever mounted on the governor stand on the gallery.

The separate hand control provided in addition to the governor contains separate valves and restoring mechanism by which the turbine gates can be operated through the pressure system, the gates being automatically maintained in any position corresponding to the setting of the handwheel. By this means the unit can be operated on hand control with the governor and all of its valves thrown out of operation and made available for inspection and repair. A clutch is provided by which the governor head may be put out of operation without shutting down the unit so that all parts can be made accessible.

Among the members of the Cramp company's organization who have been responsible for the design of this turbine installation may be mentioned H. Birchard Taylor, vice-president; John Overn, Jr., Manager I. P. Morris Department; Frank H. Rogers, hydraulic engineer, and R. E. Brunswick Sharp, assistant hydraulic engineer.

Reconnecting Two-Phase Induction Motors

(With Supplement)

Tables and Winding Diagrams Give Information Necessary for Connecting Two-Pole to Twelve-Pole Motors — Complete Data on Connecting Coils in Unequal Groups

By A. C. ROE

Detroit Service Department Westinghouse Electric & Manufacturing Company

WITH the information given in the accompanying tables and winding diagrams (see supplement) any motor-repair man should be able to connect two-pole to twelve-pole two-phase induction motors for any speed or voltage. The data and charts have been based on years of practical experience and refer to the majority of problems encountered, not to the exceptional ones. Similar tables and diagrams for three-phase motors were published in the ELECTRICAL WORLD for July 24, 1920.

From the charts it can readily be determined for what voltages and speeds it is practicable to connect any motor containing from 12 to 240 coils. If coils cannot be evenly divided between groups, the charts indicate how the coils may be divided and still get satisfactory results. The winding diagrams are grouped according to the number of poles in the winding. Both tables and diagrams apply to lap windings only.

There are one voltage table, one master grouping chart and six sub-charts. The voltage table indicates what changes should be made in connections to obtain certain voltage changes. This table is best explained by an example which has been taken as follows: Suppose it is desirable to raise the voltage of a motor connected four-parallel from 110 volts to 220 volts, what connection must be used? First, the desired voltage must be expressed in percentage of the original voltage, and in this case it is 200 per cent. Then, starting at the four-parallel line in the left-hand column, this line is followed to the right until the figure 200 is reached. Directly above 200 is given the desired connection, which is two-parallel. The table is used similarly for lowering a motor voltage. Where a blank space occurs the change is impossible with two-pole to twelve-pole machines. Even if this table indicates that a winding is possible, the grouping charts may indicate otherwise and must consequently be the final guide. When reconnecting, the voltage of a motor should not be raised so high that there is danger of the insulation failing.

MAKING CHANGES IN SPEED

Changes of speed may be obtained in an induction motor only by changing the number of poles. The synchronous speed corresponding to the number of poles is shown at the extreme left of the master chart for 25-cycle and 60-cycle motors. The highest speed at which a rotor may be run is limited by the mechanical strength of the rotor. On the other hand a considerable reduction in speed results in decreased horsepower and power factor.

After the type of winding and the number of poles desired is known, the coils must be connected in groups (if not already properly connected) and the groups must be connected together according to the type of winding. The grouping charts and the winding diagrams will assist in doing this.

The master chart contains one vertical column indicating the number of poles in the winding, another vertical column indicating the type of winding (series, parallel, etc.) and a horizontal column at the top indicating the total number of coils in the winding. Where the total number of coils can be divided evenly among each group the main chart will show the proper number of coils per group directly under the total number of coils and opposite the number of poles and type of winding used. When the total number of coils will not divide evenly, however—that is, where there are more coils in some groups than in others—a letter (*K*, *L*, etc.) will appear under the total number of coils and opposite the number of poles and type of winding to be used, indicating that the number of coils per group will have to be obtained from the supplementary table bearing the letter. If the connection desired cannot be efficiently made with the given number of poles and coils a blank space in the main chart will indicate this fact. Where a degree mark (°) appears in the master chart it is an indication that one coil will have to be left dead in each group indicated in the sub-chart by a degree sign (°).

HANDLING SPECIFIC PROBLEM

The method of using the charts can better be explained by assuming some specific conditions. For instance, suppose that a six-parallel winding is desired on a six-pole motor having sixty coils. Looking under the vertical column marked 60 opposite a six-parallel winding, it can be seen that five coils per group will give the desired arrangement. On the other hand, suppose that a two-parallel connection is desired on an eight-pole motor having sixty coils. In the sixty-coil column opposite the eight-pole, two-parallel winding will be found the reference *N*, which indicates that the coil grouping is odd and that the sub-chart *N* must be consulted. By reference to the sub-chart opposite sixty coils it will be found that the following grouping is necessary: 3, 4, 4, 4, 4, 3, 4, 4, etc. Suppose again that with this same eight-pole sixty-coil motor a four-parallel connection is desired. Inspection of the main table shows that sub-chart *N* gives the desired connection.

The connection will be the same as for a two-parallel winding, except that the degree marks would be observed because the master chart has indicated that coils must be killed. In cases where the coil always has to be killed it is indicated by a (—1) sign following the number of coils in the group. For instance, in a two-parallel winding, eight-pole, eighty-six-coil machine Table *N* indicates that the number of coils per group will be 6 — 1, 5, 6 6, 5 5, etc.

Besides helping in rewinding or reconnecting motors these charts are useful in determining which is the best design for any machine. For instance, it can be seen that in a ninety-six-coil motor two, four, six, eight

or twelve-pole connections are possible, and that ten-pole series or two-parallel connections are possible without killing any coils, although an odd grouping is necessary.

It will be noted that the number of coils is used throughout this article in preference to the number of slots. This makes the data apply to all cases irrespective of the number of coils per slot.

CONNECTING DIAGRAMS

In order to facilitate the use of the connecting diagrams on this supplement they are numbered and lettered uniformly throughout. The numbers outside of the circle indicate the number of the groups which they are opposite. The numbers inside indicate the two ends of each pole-phase group. Where one of these inside numbers is repeated this indicates that the two groups so numbered should be connected together at these points. The numbers are so arranged that when a machine is to be changed to a different connection with the same number of poles the change can be obtained by inspection of the two diagrams corresponding to the two connections. For instance, with a four-pole machine—suppose a change is to be made from a series winding to a two-parallel winding. Starting at the top of the first diagram showing the series winding and proceeding clockwise, the numbering on the coil groups is as follows: On the first diagram of the two-parallel winding, proceeding in the same direction, the lettering is the same until the upper end of group No. 4 is reached, where 5 has been changed to A_1. This means that the jumper which formerly connected around to the right to the other 5 has now been swung around to A_2, in order to make the two-parallel connection. Likewise the jumper from 6 in group No. 5 has been swung around to B_2, and 5 from group No. 3 has been swung around to A_2. By completing these changes the motor is reconnected from a series to a two-parallel winding.

It will be noted that there are two drawings for some types of connections. For instance, there are two series-connected windings for the four-pole machine. The first of these drawings shows what is called a "top-to-bottom" connection and the second a "top-to-top and bottom-to-bottom" connection. These are indicated on the diagram by the letters *T-B* and *T-T*. In the top-to-bottom connection the jumpers connect all like poles, skipping alternate poles. In the top-to-top connection the jumpers pick up adjacent poles. The *top-to-top connection should be used for all odd coil groupings* which are given on the charts. In reconnecting for a different voltage a *T-B* diagram must be used in conjunction with a *T-B* diagram; likewise a *T-T* with a *T-T* diagram.

There is one two-speed winding shown in the six-pole group. The motor may be operated as a six-pole or a twelve-pole machine by making the connections indicated in the footnote at the bottom of the group.

The method of using these diagrams and charts as practiced by the writer is as follows: Instruction is given to the winder as to the number of coils in each group, and if the grouping is odd the instructions are written on paper in the order shown on the chart, as, for instance, 4 4 5 5 4 4 5 5. After the coils have been connected in groups or "stubbed" by the winder, all of the top leads of each group are bent out from the center of the machine and all of the bottom leads are bent in toward the center. The beginning and end of each coil are tagged according to the diagram with metal or fiber tags having numbers corresponding to the numbers indicated on the diagram at the ends of the coil groups. These tags are drilled so that they can be slipped on the leads. After the foreman or head winder has checked the tagging the winder connects the leads by putting a jumper from each number to the corresponding like numbers. If only two tags are removed at once, there is less chance for mistakes. When all the jumpers are on, the motor leads indicated in the diagram by A_1, B_1, A_2, B_2, can be put on, after which the winding may be soldered and the joints insulated, etc.

A feature of the diagrams is that it is not actually necessary to follow the lines as the figures and letters denote which leads are to be connected together. Thus it is not necessary for a man out on the job to have a diagram, provided he has the numbering, which may even be telephoned to him. For instance, for the four-pole series winding the necessary data would be: $1\text{-}B_1$, $4\text{-}A_1$, $6\text{-}3$, $5\text{-}2$, $6\text{-}1$, etc. The first number in each group represents a top lead and the last number a bottom lead (or vice versa), and the number underneath each group designates the number of coils in the group. If the coil grouping is even these numbers underneath are not necessary.

The diagram of the two-speed, three-phase winding shown in the six-pole group in the article printed in the ELECTRICAL WORLD for July 24, 1920, should have been accompanied by an explanatory note showing what terminal connections to make for each speed. For a twelve-pole winding *A*, *B* and *C* should be the line terminals and A_1, B_1 and C_1 should be left open. For a six-pole winding A_1, B_1 and C_1 are the line terminals and *A*, *B* and *C* are tied together.

The Real Meaning of Productive Illumination Intensities

Since the Intensity of Light Reaching the Eye Is What Counts, the Coefficient of Reflection of the Work Plays Important Part

BY DAVIS H. TUCK
Electrical Engineer Holophane Glass Company

IN PLANNING illumination systems one is apt to get into a rut regarding the intensity of illumination specified for specific purposes. In general one thinks of 2 foot-candles as low-intensity illumination, 20 foot-candles as high-intensity illumination and 6 foot-candles as average good illumination.

An error of the past—and of the present too—is to pay too much attention to the foot-candle intensity of illumination delivered to the work and to give too little thought to the foot-candle intensity that is reflected from the work to the eye. The reading of the foot-candle meter should be used in conjunction with the coefficient of reflection of the work. The importance of this reflection factor is well shown in the illustration, where one shop requires over ten times the foot-candle meter reading of the other for productive intensity.

The eye fortunately functions almost equally well over a wide range of light intensity. Objects are seen mainly by their difference in brightness or contrast. The eye

can distinguish contrast in adjacent surfaces differing in brightness by somewhat less than 1 per cent, the exact value depending upon the individual and the state of adaptation of the eye. This small difference in brightness of approximately 1 per cent represents the beginning of visibility by contrast and is practically independent of the absolute illumination intensity over a wide range of values. Experimentally this least perceptible difference in brightness is well confirmed and is known as "Fechner's fraction."

The psychological basis of illumination is largely dependent on the limits of absolute illumination between which Fechner's fraction holds true, as after an intensity of illumination is reached where Fechner's fraction applies the eye can see nearly as well under one absolute intensity of illumination as another.

Experimentally it has been found that after the illumination affecting the eye has become 2 foot-candles the eye has attained nearly its full value of sensitiveness. There is a very slow and small gain in eye sensitiveness beyond the absolute illumination value of 2 foot-candles, the eye retaining practically uniform sensitiveness up to illumination intensities far beyond practical values.

Another quality of the eye has an important bearing on practical illumination, *i.e.*, visual acuity, or the capacity of recognizing fine detail. It has been found by experimental tests that visual acuity reaches its normal value at the same point of illumination intensity as Fechner's fraction. That is, above 2 foot-candles the increase in the sensitivity of the eye to distinguish difference in brightness and the ability to distinguish fine detail is very small.

We therefore have a well-proved fundamental law. The eye is practically in full action for seeing when it receives an illumination of 2 foot-candles. This illumination of 2 foot-candles must be received by the eye and is not that which is measured by a foot-candle meter. The readings obtained by a foot-candle meter give a measure of the efficiency of a lighting system but do not tell whether the illumination received by the eye is adequate.

For the illumination which is measured by a foot-candle meter to indicate the critical value of 2 foot-candles available to the eye it must be $E = a/k$, where E is the illumination measured by the foot-candle meter, a is 2 foot-candles and k is the coefficient of reflection of the surface being worked upon.

Assuming the work is being done on white cloth where $k = 0.7$ then for the eye to work to the best advantage the foot-candle meter must read $E = 2/0.07 = 2.86$ foot-candles. Fig. 1 shows a weave room of a mill where this condition is met. The lighting equipment is as follows:

Reflector—Holophane CSI75VF.
Lamp—75-watt, type C, bowl frosted.
Spacing—14 ft. 6 in. x 14 ft. 6 in.
Mounting height above floor—10 ft. 10 in.
Illumination intensity—3 foot-candles.

Inasmuch as a further increase in illumination would not make a corresponding increase in eye sensitivity or visual acuity, the illumination of 3 foot-candles for this particular mill is ample and 3 foot-candles is a productive intensity.

The writer was called upon to inspect a painting room of a motor-car factory, shown in Fig. 2, where the following lighting equipment was used:

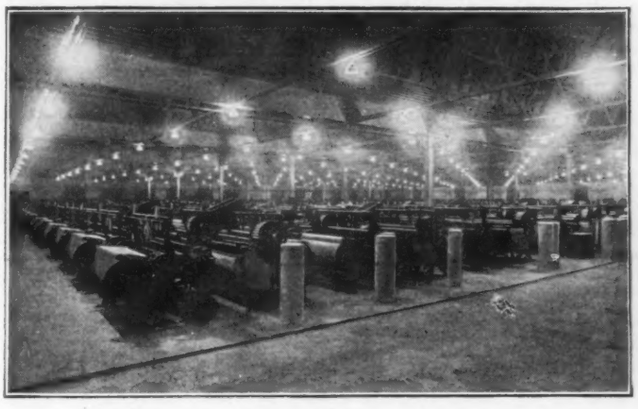
Reflector—Holophane 2110VF.
Lamp—100-watt, type C, clear.
Spacing—10 ft. x 10 ft.
Mounting height above floor—10 ft.
Horizontal foot-candle intensity—7.5.
Vertical foot-candle intensity—4.5.

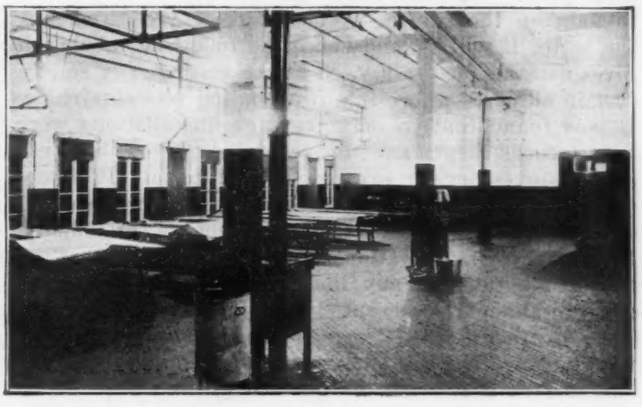
The work is done on the vertical sides of automobile bodies, which are painted black. It was found that k for the black automobile bodies was 0.053 and that, although the foot-candle meter registered 4.5 foot-candles on the vertical sides of the body, the foot-candle value that was actually effective on the eye was 0.24 foot-candles ($4.5 = a/0.053$).

Now, in order to bring this system up to productive illumination it is necessary to increase the illumination on the vertical surface to 38 foot-candles ($E = 2/0.053$).

The object of reviewing the above is to bring out the real meaning of productive illumination. Productive illumination does not necessarily mean very high foot-candle values as measured on a foot-candle meter but means that, taking into account the value k (coefficient of reflection of the work), the illumination actually active on the eye must be not less than 2 foot-candles.

It should be noted that whereas a light-measuring instrument which indicates foot-candle values incident on the work, and not the intensity reaching the eye, is excellent for use in making comparative readings of illumination to measure the light-producing efficiency of an illuminating system, it should be used with discretion in constructive illumination planning.





PRODUCTIVE ILLUMINATION IN THESE TWO FACTORIES REQUIRES WIDELY DIFFERENT FOOT-CANDLE METER READINGS

(1) A weave shed where the work is done on white cloth, using 3 foot-candles as measured with a foot-candle meter (Tremont & Suffolk mills). (2) An automobile painting room where 38 foot-candles is employed. The much higher intensity is required because of the black surface worked upon. (Chevrolet motor-car factory, Tarrytown, N. Y.).

Relation of Lighting Feeders to Watts per Square Foot

Tabulation: to Show Actual Demand Factors and Units per Square Foot Used in Different Classes of Business and Industry

BY VICTOR TOUSLEY

IT IS a rational assumption that the intensity of illumination used in any particular place will be governed by the requirements of the business carried on and not by the number of sockets installed. If the number of sockets provided is relatively small, high-wattage lamps will be used, if large, small-capacity lamps will be provided or many of the sockets will not be used at all. Hence the size of mains required to carry the maximum load for illumination is best determined on the basis of the maximum watts per square foot used in the given line of business. Demand factors in this connection are of little use except in special installations, such as in photographic rooms of engraving firms, for instance.

For power purposes the wattage per square foot, on the other hand, is of little use and applicable to special cases only. But the more information it is possible to gain on the subject of actual power requirements, the better it will be, and hence the following tabulation gives demand factors as well as the wattage per square foot in all cases where this information was obtainable. It was found that in only very few installations were any records kept, and in several lines of business it was necessary to arrange special tests. In many other cases the demand factors given are based on statements of engineers and switchboard attendants. During this investigation it was also found that no two installations in any line of business were nearly enough alike to warrant indiscriminate use at one place of the figures obtained in another. It is for this reason that the maxima, minima and averages obtained in each classification are given.

It is also stated in connection with each group whether the factors given apply to straight lighting, power or mixed loads. The watts per square foot given are all based on rough measurements of outside dimensions of buildings such as one could readily make with a tape line in the field or with a common rule from plans. The effect of all minor irregularities was estimated and no accurate measurement was made. Basements and attics were always counted in.

APARTMENT BUILDINGS (*Mixed Load*)

	Minimum	Maximum	Average
Watts per square foot	0.05	0.30	0.17
Demand factors in per cent	12	59	38

The highest demand factors as well as the highest wattage per square foot are likely to be found in connection with the smaller apartments or where occupants rent rooms.

CLOTHING MANUFACTURE (*Mixed Load*)

	Minimum	Maximum	Average
Watts per square foot	0.61	2.6	1.37
Power load: Demand factors in per cent	82	105	94

Some of the installations investigated include office and storeroom space; others merely the shop.

Very little useful information on cooking installations is at present available. With the exception of cases where the ovens are in continuous use the conductors will probably be of sufficient capacity if they can carry the total connected load for thirty minutes after having carried half their load for an hour before.

CRANES (*Power Load*)

	Minimum	Maximum	Average
Demand factors in per cent	10	54	27

The high demand factor in this case was obtained from three ore bridges unloading a vessel and all three working steadily. The minimum record was obtained in a railway shop.

DEPARTMENT STORES (*Mixed Load*)

	Minimum	Maximum	Average
Watts per square foot	1.02	1.54	1.28
Demand factors in per cent	37	56	46

The watts per square foot and demand factors were not obtained from the same installations. In some of the stores elevators were not electric. In less pretentious neighborhoods brilliant lighting effects are not much sought after and showcase lighting is kept at a minimum.

ELEVATORS, PASSENGER (*Power Load Only*)

	Minimum	Maximum	Average
Demand factors in per cent	32	68	45
FOUNDRIES (*Mixed Load*)			
Demand factors in per cent	36	50	48
GARAGES, PUBLIC			
Demand factors in per cent	19	56	34

In large private garages the peak load is often purposely kept low and much below the average of public garages.

HOSPITALS (*Mixed Load*)

	Minimum	Maximum	Average
Watts per square foot	0.23	0.45	0.33
HOTELS (*Mixed Load*)			
Watts per square foot	0.45	1.75	0.90
HOTELS (*Lighting Only*)			
Watts per square foot	0.17	0.45	0.28

The maximum for mixed load in this case was found in a small club house heavily motored for laundry and ventilation purposes.

MACHINE SHOPS, JOBBING (*Power Load*)

	Minimum	Maximum	Average
Demand factors in per cent	25	40	33

These figures refer to shops in which jobbing is done, and all of them include crane service. Machine shops engaged in general manufacture of standard parts are classed with "Manufacturing."

MANUFACTURING, GENERAL (*Lighting Only*)

	Minimum	Maximum	Average
Watts per square foot	0.27	1.25	0.48
Power: Demand factors in per cent	27	79	48
Mixed load: Demand factors in per cent	20	66	48
OFFICE BUILDINGS (*Mixed Load*)			
Watts per square foot	0.68	1.20	0.85
PACKING HOUSES (*Power Load*)			
Demand factors in per cent	60	68	64
PRINTING (*Mixed Load*)			
Watts per square foot	0.58	1.20	0.85
Demand factors in per cent	33	70	45

Some printing establishments include office and storage space as well as engraving and composing rooms; some have only the printing machinery.

RENTED BUILDINGS (*Mixed Load*)

	Minimum	Maximum	Average
Watts per square foot	0.30	1.65	0.96

Buildings here referred to are occupied by small tenants carrying on various lines of business.

TANNERIES (*Mixed Load*)

	Minimum	Maximum	Average
Demand factors in per cent	40	62	50

In some of these tanneries the manufacture of gloves and other leather products is carried on.

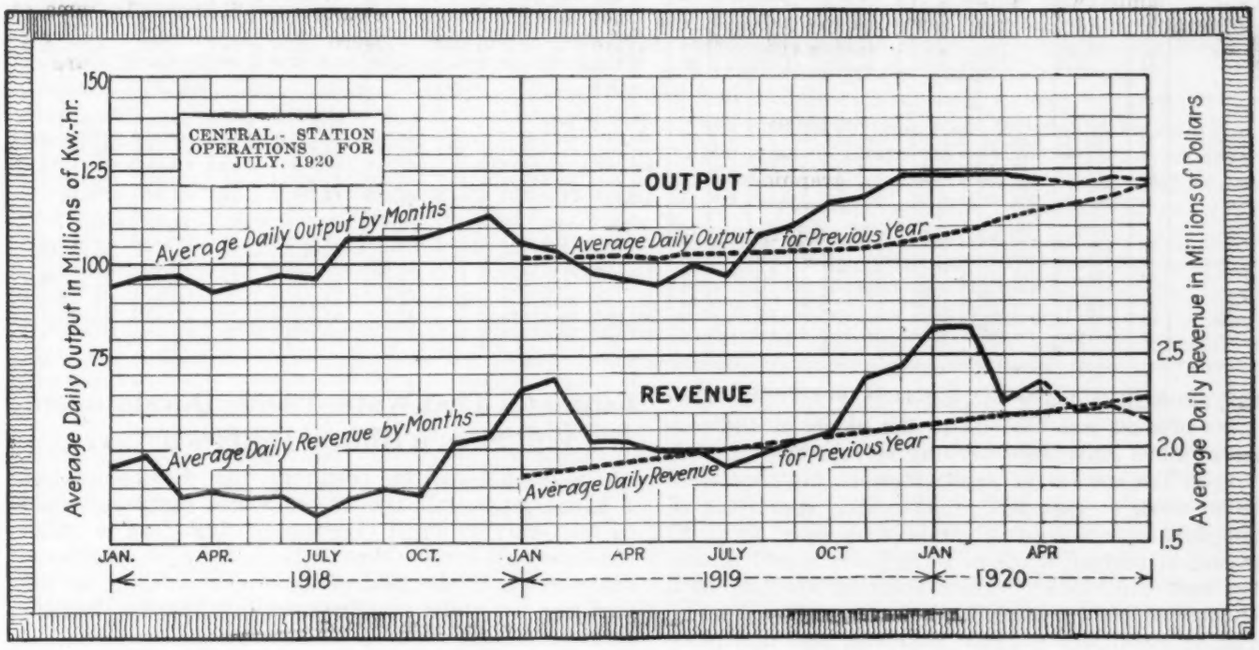
With theaters the watts per square foot in the auditorium usually equals 1.25. This equals about 7.5

watts per seat. In large houses a stage capacity of about 100,000 watts is probably the highest ever called for. Electric signs and lobby illumination have a demand factor of 100 per cent. The general mains supplying the whole installation should have a carrying capacity equal to the demands of auditorium, lobby, signs and dressing rooms for one hour and the stage capacity in addition for about fifteen minutes. The full stage capacity is sometimes on for five or ten minutes before the curtain rises and the auditorium lights are cut off. This will, of course, occur only in the event that a show opens with its maximum illumination.

WAREHOUSES (*Lighting Load Only*)	Minimum	Maximum	Average
Watts per square foot.....	0.03	0.11	0.07
WHOLESALE HOUSES (*Mixed Load*)			
Watts per square foot.....	0.19	0.93	0.44

This classification does not include wholesale dry goods houses. In some wholesale houses quite a great amount of power is used.

Midsummer Operations Increase



UNUSUAL stability in midsummer central-station operations is indicated from returns received by the ELECTRICAL WORLD for the month of July. Prior to this year energy production has in general shown a decided drop during the summer months as compared with that of the previous winter season, but the output for the month of July of this year in the country considered as a whole was only 72,000,000 kw.-hr., or 1.8 per cent, below that recorded in December, 1919. In 1918 the midsummer production was larger than that of the previous winter, owing entirely to abnormal requirements. The gross revenue during July that year was, however, 10.1 per cent less than that recorded in December, clearly indicating the large loss in revenue during the summer months due to decreased demand for energy for lighting.

During July curtailment of production in many lines was reported, especially in the textile and related industries. This resulted in odd-time work and in some cases complete shut-downs, and, taken in connection with the continued poor transportation conditions, is naturally reflected in a slightly decreased energy demand under that of June in every section of the country except the South Central States and the Mountain-Pacific Section. Factory operations in New England during July decreased slightly under those of June, and a consequent slight falling off in power demand is reflected by the central-station returns from that section. The question of transportation was still a dominating influence in the North Atlantic and North Central States. The iron and steel industry was espe-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Ratings Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Aug.	54	$32,756	$29,006	13.0	54	1,801,836	1,793,706	0.5
Sept.	53	32,344	28,336	14.0	53	1,761,582	1,695,862	4.3
Oct.	55	35,492	30,077	18.0	60	2,175,636	1,987,004	9.0
Nov.	53	37,439	31,927	17.2	58	2,055,428	1,895,693	8.2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10.6
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.	65	46,155	36,840	25.0	70	2,698,890	2,103,587	28.0
April	65	45,547	36,541	24.5	70	2,603,692	2,098,559	24.1
May*	65	43,888	35,512	23.4	70	2,631,560	2,179,916	21.2
June†	66	44,313	35,525	24.7	71	2,621,123	2,182,337	20.0
July‡	66	44,312	35,779	23.6	71	2,688,280	2,261,839	18.8

*Includes estimates for thirteen companies, representing 0.5 per cent of the total installed rating of all central stations.
†Includes estimates for forty-two companies, representing 7.9 per cent of the total installed rating of all central stations.
‡Includes estimates for eighty-four companies, representing 19.2 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States		
		Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	Aug.	74	$4,225	$3,693	14.4	57	$12,174	$10,995	11.1	47	$9,295	$7,924	15.8	39	$1,647	$1,385	18.4	61	$5,415	$5,009	8.5
	Sept.	73	4,019	3,536	13.6	53	11,429	10,069	13.5	46	9,671	8,278	16.6	38	1,724	1,488	16.0	63	5,501	4,965	10.9
	Oct.	72	4,127	3,453	19.1	53	12,684	10,822	16.9	52	11,401	9,484	20.2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov.	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21.2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec.	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	5,635	4,718	19.8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar.	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,143	5,741	24.2
	April.	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5,992	19.2
	May.	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6,147	15.1
	June.	82	4,903	3,778	30.0	65	16,450	13,469	22.1	57	12,411	9,753	27.4	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July.	82	5,016	3,892	28.9	65	16,808	13,432	25.1	57	12,721	9,828	29.2	54	2,740	2,198	24.5	79	8,023	6,429	24.5
			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
KW.-HR. OUTPUT	Aug.	74	161,431	153,266	5.1	57	640,616	662,120	-3.2	47	496,745	460,360	8.0	39	58,991	53,231	10.2	61	444,026	464,729	-4.2
	Sept.	73	153,837	146,209	4.5	53	610,254	610,179	0.1	46	515,519	463,929	11.5	38	58,316	54,838	6.3	63	423,656	420,707	0.5
	Oct.	72	162,859	142,326	14.4	53	694,584	659,859	5.3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov.	71	153,171	140,240	9.2	56	724,607	707,347	2.4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec.	73	180,493	152,304	18.0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April.	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May.	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June.	82	187,526	150,073	25.0	66	861,411	722,782	19.3	74	852,016	686,921	24.2	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July.	82	191,880	159,265	20.4	66	877,841	712,450	23.2	74	853,230	729,843	16.9	56	139,363	106,389	30.9	79	626,265	553,892	13.1

cially affected, it being estimated that 2,000,000 tons of this product was tied up in the hands of the producers. Steel mills were working on schedules dependent upon the arrival of raw materials, but few were able to work at capacity. Coal-mining operations in Pennsylvania and West Virginia were only about 50 per cent of normal, while in Ohio, Indiana and Illinois they were still lower. Manufacturing centers, such as Rochester and Philadelphia, however, reported transportation conditions slightly improved, and this probably accounts for the fact that the average daily energy output in the Atlantic States in July was only 630,000 kw.-hr. less than during June.

The North Central States reported a general slowing down in manufacturing. The automobile and allied industries were especially affected, large numbers of men being laid off in this class of manufacturing plants. Moreover, the breakdown of a 45,000-kw. unit in Detroit resulted in a curtailment of output for that section. This decreased industrial activity is reflected in a loss of 1,180,000 kw.-hr. in average daily energy demand under that of June.

Labor shortage hindered maximum operations in most of the mining regions of the Mountain States. The Pacific Coast States reported the usual prosperous conditions, especially in the Northwest. The entire Mountain-Pacific section reported an energy output of 793,000,000 kw.-hr. for July, which is virtually the same as was recorded in December, 1919, the record month for the country. The average daily output for the month exceeded that of June by 820,000 kw.-hr.

The stability of the central-station industry in this section is indicated by the fact that at no time during the present year have the monthly operations shown a decrease over the preceding month. No other section of the country can show such a consistent growth during the past half of the present year.

Estimates That Water-Power Development Will Save a Billion Dollars a Year

A SURVEY of the resources and development of water power in the United States has been issued by the Guaranty Trust Company of New York in which the statement is made that probably the most significant achievement in the field of American industry in the post-war industrial readjustment is to be the development on a large scale of the nation's vast water-power resources. With the revival of normal industrial activity by the recently belligerent nations, the company points out, competition in the world's markets will become increasingly severe. Economy in the application of power to the production and transportation of goods will in large part measure the competitive ability of the various nations. As emphasis is more and more placed upon cheapness of power resources, coal and iron alone henceforth will not be such decisive factors in measuring the potential industrial capacity of nations. Water power will have a new significance as a national asset. It is estimated the United States has the means for effecting a saving of its energy supply well in excess of a billion dollars a year. This can be effected only through a fuller utilization of the nation's water-power resources.

The Guaranty Trust Company's survey gives figures compiled by the United States Geological Survey on coal deposits, petroleum production and actual and potential water-power development and sums up the chief provisions of the federal water-power law. Stating that the need for water-power development is a matter of relative economy rather than of an actual shortage of solid fuel in the United States, it declares that "it is in the possible reduction of the proportionate reliance of the industries and the transportation systems upon bituminous coal for energy that water-power development promises the greatest economies."

Readers' Views and Comments

Destruction of Conduit Laid in Cinders

To the Editor of the ELECTRICAL WORLD:

SIR: A subject of vast importance to electrical engineers, as well as to construction companies and building owners, has recently arisen in this city. In the course of building an additional story to one of our largest buildings it was necessary to remove a portion of the original roof. It consisted of a 6-in. layer of cinders, 7 in. of concrete and several layers of roofing paper, which had been thoroughly tarred. The cinder layer was in direct contact with the electric conduits at the time of construction eight years ago. When exposed it was found that the galvanized conduit had been entirely destroyed in many places by the action of the sulphuric acid and other destructive agencies in the cinders. This condition would have made it impossible to remove the wires from the conduits for purpose of renewal or repairs.

Architects who examined the roof said they had never seen such complete destruction of conduit before. The remedy for the trouble would be a grouting of cement wholly surrounding the conduit when it is installed. The roof beams and channels had been protected by concrete and were saved from the destructive action of the cinders.

ISRAEL LOVETT,
City Electrician.

Omaha, Neb.

A Fine Point in Electrical Jurisprudence

To the Editor of the ELECTRICAL WORLD:

SIR: The Alabama courts, as noted the other week in your "Recent Court Decisions," have refused to permit the recovery of damages in the case of a workman killed because of receiving an electric shock through an imperfectly insulated lamp wire. It was proved to the satisfaction of the courts that the charge could not have been more than 120 volts, and this the courts agreed with the electrical experts was not a fatal voltage even though the victim was perspiring and standing on a damp board. None the less the man was dead, and in refusing to apply the time-honored legal doctrine of *res ipsa loquitur* (the thing speaks for itself) a complexion was given to the case that were it a less serious matter would savor of comic opera. The man was a negro, and counsel for the plaintiff advanced the idea that negroes are more susceptible to electric shock than whites. More plausibly, the man died from a cessation of heart action due not to the actual shock but to fright. Admitting this hypothesis, was the verdict a right one? If the equipment had been in perfect order and he had been frightened to death by some mistaken notion of danger, clearly the company would not have been to blame; but where a shock, however slight, is actually received because of a fault in the equipment and death ensues is it not poor public policy for the company responsible for the defect to take refuge in a theory that to every layman will appear glaringly contradicted by the facts?

FRANK W. CHASE.

Brooklyn, N. Y.

Babcock & Wilcox Oil-Burning Furnace

To the Editor of the ELECTRICAL WORLD:

SIR: In your issue of Aug. 14, in the article "Considerations in the Burning of Fuel Oil," page 328, the Babcock & Wilcox oil-burning furnace was described in some detail. No mention was made of the fact that this furnace is patented and is installed in boilers manufactured by this company only. We shall be glad if you can mention this fact in your paper, as otherwise we are fearful that persons unfamiliar with this fact might install such furnaces, in which event it would be necessary for us to protect our patents.

A. G. PRATT,
Vice-President Babcock & Wilcox Company.

New York City.

Co-ordinating the Work of Scientist and Engineer

To the Editor of the ELECTRICAL WORLD:

SIR: In terms of research we must account for many of the spectacular successes of our industries. Not as a fad, a merely temporary trend, has it aroused popular interest, but as the tried and proved method of many large corporations and the more helpful government bureaus. With the achievements of research methods in electricity and chemistry, in medicine and agriculture, we were all somewhat familiar before the war. The wide variety of problems which then arose has emphasized the national importance of scientific research.

Our National Research Council, born in wartime, is now "carrying on" as a peace-time organization for the encouragement and guidance of industrial research. Manufacturers and even producers, like cotton and raisin growers, are hastening to organize laboratories in which to study their particular problems. They are besieging our universities for graduates with higher degrees who are skilled researchers in pure science, although they may be correspondingly ignorant of industrial processes.

What contribution do such men promise which places them on an equality with many of us who have years of technical experience? While we were learning to make things go under practical conditions, they were learning to question the hidden operations of nature, to divide the uncut atom, and to count its electrons. A difference in kind of training and of work makes competition impossible and co-operation essential. You cannot have a race between an engineer who is interested in locating and utilizing oil deposits and a scientist who is interested in how hydro-carbons are formed and how to crack their molecules. Perhaps, more than in training, these pure scientists are contributing in their point of view. They seek first a knowledge of nature, feeling sure that all the material advantages and practical applications will be added. A widening of the boundaries of human knowledge is their aim, and their chief joy is in discovery. For others they leave the equal joy of exploiting the newly opened territory. Of course, years may elapse between discovery and utilization, as was true in the case of electromagnetic waves, predicted by Maxwell, experimentally detected by Hertz, and adapted to human needs by Marconi. No one questions the importance of each contribution in this sequence, but how many picture the possibilities of rapid progress when scientist and engineer are in a co-ordinating organization?

JOHN MILLS.

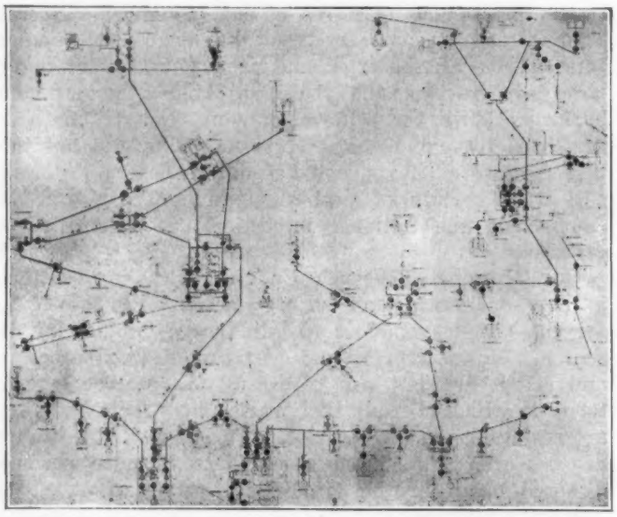
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Dispatcher's Board That Facilitates Switch Changes

A SYSTEM operator's board arranged so the plugs indicating closed switches may be pushed through the board with a pencil, thereby permitting light from lamps mounted in the rear to shine through and indicate open switches, has been designed by the Consumers' Power Company of Jackson, Mich. The board illustrated



SMALL DRAWER BENEATH BOARD CATCHES PLUGS USED FOR INDICATING CLOSED SWITCHES ON THIS BOARD

is mounted above the dispatcher's telephone desk within easy reach, so that changes may be made upon it without the dispatcher leaving his seat. The plugs used are of rubber and are made to fit easily in the holes representing the switches. When the plugs are pushed through the board they fall into a trough at the bottom, from which they are recovered for use again at some future time.

F. W. POLLOCK,
Load Dispatcher.
Consumers' Power Company,
Jackson, Mich.

Economizers Save Seven per Cent of Total Heat

SEVEN per cent of the B.t.u. obtained was returned to the feed water by economizers during a month's run of the new 62,500-kva. West End station of the Union Gas & Electric Company, Cincinnati, Ohio, and an over-all efficiency of 18.46 per cent from fuel to switchboard was realized. The average fuel consumption was 18,500 B.t.u. per kilowatt-hour, using equipment consisting of two 31,250-kva. turbines and eight 12,250-sq.ft. (1,130-sq.m.) Babcock & Wilcox boilers with Sturtevant economizers. During the run the maximum demand was 52,000 kw. and the load factor 54 per cent. The coal as fired had 12,500 B.t.u. per lb. (1,425 cal. per kg.), 1.48 lb. (0.67 kg.) per kilowatt-hour being fired.

With condenser losses of 53.48 per cent of the total heat the turbine showed an efficiency of 26.6 per cent.

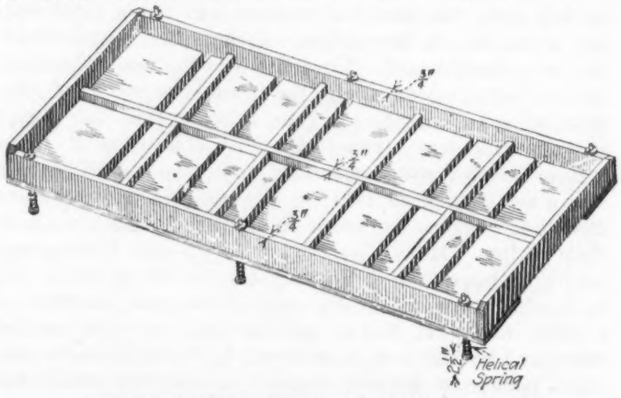
DISTRIBUTION OF HEAT LOSSES IN WEST END (CINCINNATI) STATION

	Per Cent	B.t.u.
Boiler-Room Losses:		
Combustible in ash	5	925
Radiation and leakage	1	185
Stack	16	2,960
Gross boiler-room losses	22	4,070
Gain by economizers	7	1,295
Net boiler-room losses	15	2,775
Auxiliary losses:		
Steam storage loco, after crediting exhaust	0.22	40
Steam heating and auxiliaries	8.40	1,550
Turbine losses:		
Friction and windage	2.40	450
Condenser cooling water	53.48	9,850
Returned to condensate	.....	50
Generator losses:		
Electrical	0.84	155
Electrically driven auxiliaries and steam used for same	1.16	215
Total of all losses	81.54	15,085
Over-all thermal efficiency	18.46	.....

The coal contained 11.8 per cent ash, and the residue from the furnaces had 27.2 per cent combustible; thus the loss in the ash was 5.0 per cent. A third turbine and bank of boiler is now being installed and a fourth unit is on order. The plant is designed for firing with either coal or gas.

Spring Rack Prevents Damage to Meters in Automobile

TO PREVENT changes in the calibration of meters when they are transported in an automobile, an Eastern utility uses the platform shown in the accompanying sketch, which is mounted on springs so that



SPRINGS ON RACK PREVENT DAMAGE TO METERS WHILE IN AUTOMOBILE

the meters do not get the full force of jars transmitted through the car. This platform is made long enough just to slide into a Ford truck back of the seat, the legs resting on the floor of the car. It accommodates two

rows of meters, seven in a row. Two ⅜-in. (1-cm.) boards running lengthwise are fastened to the bottom of the side pieces. These boards support wide slats forming the bottom of the rack. The meters are supported by these slats and are separated by partitions of ¾-in. (2-cm.) wood running lengthwise and across the rack. The spaces between the separators are left ⅛ in. (3 mm.) larger than the back of the meters.

The frame is supported by six springs, loose, on ⅜-in. brass tubes, the latter being screwed into nuts to give a flat surface on the floor. The springs are similar to those on screen doors, but must not be too stiff or their purpose will be defeated. Washers are placed on top and bottom of the frame where the tubes pass through, and tube, spring and frame are held by a cotter pin.

The rack should be made light, since the meters will furnish the weight necessary to hold the frame down.

Hartford, Conn. T. T. THOMAS.

Operation of Auto-Transformers to Avoid Trouble

AUTO-TRANSFORMERS used to interconnect two systems are usually connected Y in order to realize the maximum economy over a straight transformer. Unless provided with a delta-connected secondary, such an auto-transformer is subject to triple-frequency voltage between terminals and ground owing to the suppression of the third-harmonic exciting current. If the transformer is of the three-phase core type, this triple-frequency voltage is greatly reduced by the high reluctance thereby inserted in the flux path. Hence three-phase, three-legged core-type construction is strongly recommended for Y-connected auto-transformers without delta secondary. There is very little danger if the auto-transformer neutral is connected to the generator neutral. If the neutral of either system is grounded, a solid ground on the neutral of the auto-transformer will provide a source of third-harmonic exciting current and reduce the liability of trouble from triple-frequency voltage between line and ground. However, this may cause trouble from telephone interference and should not be depended upon for protection unless the system ground is thoroughly reliable and cannot be tripped off.

For the protection of the low-voltage system against abnormal electrostatic stresses in case of a dead ground on one phase of the high-voltage system at or near the auto-transformer, a solid ground on the neutral of the auto-transformer has generally been recommended where there is much difference in potential between the two systems. If the systems contain appreciable electrostatic capacitance to ground, any triple-frequency voltage between line and ground will cause third-harmonic charging currents, which react on the triple-frequency emfs., intensifying them.

Leaving the auto-transformer neutral isolated does not reduce triple-frequency voltages, if such exist, but does prevent their amplification through the line capacitance; however, it exposes the lower-voltage system to electrostatic stresses from grounds on the high-voltage system. Under certain conditions dangerous voltages may be built up. Particularly should the following conditions be avoided:

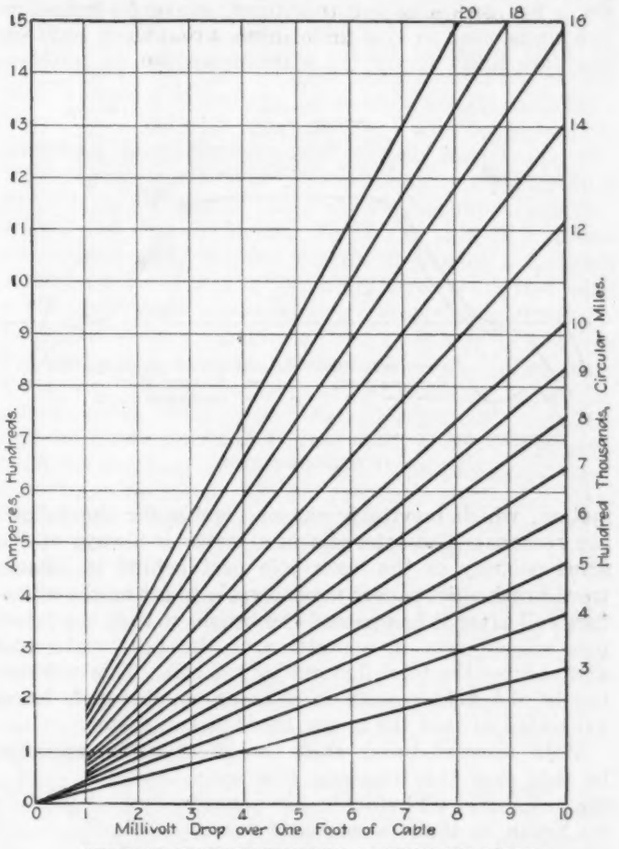
1. An auto-transformer made up of single-phase units or a three-phase shell-type machine without delta secondary.

2. The use of no other grounds on either high- or low-tension systems when the auto-transformer neutrals alone are grounded or the latter are not connected to the generator neutrals.

ROBERT TREAT,
Engineer Power and Mining Department.
General Electric Company,
Schenectady, N. Y.

Current Determined by Voltage Drop in 1 Ft. of Cable

MEASUREMENT of the current flowing in a cable can be determined by taking voltmeter readings and referring them to the accompanying chart. This is accomplished without opening the circuit and thereby shutting down the apparatus to which the cable is



VOLTAGE DROP DETERMINES CURRENT IN CABLE

supplying power by the use of two sharp steel or brass points driven through the insulation of the cable 1 ft. (30 cm.) apart. This distance must be carefully measured, for upon that depends the accuracy of the result.

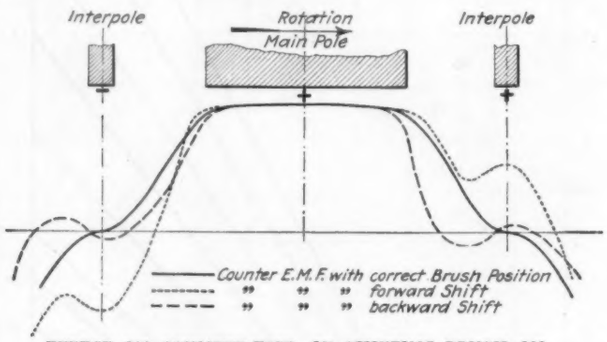
The drop in potential across the distance is then read on the milli-voltmeter. The current flowing is found by reference to the curves shown. By picking off on the curve corresponding to the size of the cable the voltage drop just determined the current is easily found. For example, suppose that a drop of 6.3 mv. was found over a foot of 500,000-circ.mil cable. By reference to the curve for this size we find the current to be 294 amp. In the absence of this curve one can easily find the current by reference to a copper-wire table giving the resistance of 1 ft. of the cable and multiplying this by the reading of the instrument in volts.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Wrong Brush Position Changes Speed of Interpole Motor

INCORRECT brush position on an interpole motor shows up as sparking and speed variation with load. On a non-reversing motor without interpoles operators are accustomed to give the brushes a backward lead, and they are likely to try the same procedure on interpole



EFFECT ON COUNTER-EMF. OF SHIFTING BRUSH ON INTERPOLE MOTOR

motors, which inevitably causes trouble for the following reasons: The interpole in a motor is always of the same polarity as the main pole next behind it. Backward brush shift causes the interpole to act on the armature coil after it has passed the brush, so that the interpole merely acts in opposition to the next main pole and reduces the total flux cut by the coil. This weakening of the field results in a lower counter-emf. being generated so that the motor tends to run faster.

With forward brush shift the effect is the opposite. In this case the interpole acts upon the armature coil before it has passed the brush, so that its magnetic flux is added to the flux of the same polarity from the pole behind it, thus increasing the total flux and counter-emf. generated, tending to slow the speed of the machine.

By the same manner of reasoning it may be seen that interpoles which are too strong have an effect similar to back shift of brush and tend to make the motor speed up as load is applied. Weak interpoles act in the same manner as forward shift of the brushes and cause the speed of the motor to drop with load. To reverse an interpole motor the shunt and the main series fields (if it is compounded) may be reversed simultaneously, or else the armature and interpole circuit may be reversed. If the interpole strength is correct and the brush position is right, an interpole motor will run very close to the same speed at all loads and will run at the same speed in both directions of rotation.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Oil on Brush Holder Causes Commutation Trouble

OIL accumulating on the lower brush and holder of a 10-hp. motor in an Eastern factory was recently the cause of the brush sticking and consequent bad commutation and brush and commutator trouble. The oil would accumulate on the brush and holder and become gummy, thus causing the brush to stick. On investigation it was found that the lower brush was directly below the motor shaft and exactly between two poles. Thus oil would tend to run to this brush s it was the lowest point on the brush-holder rings, and besides the draft from the rotating armature was strongest between the two poles and tended to draw oil in toward the machine onto the brush. It was found that the armature coil was constructed (Fig. 1) so that one of the leads came straight out of the slot to the commutator bar, while the other lead of the same coil was brought practically quarter way around the armature to the next adjacent commutator bar. In order to change the position of the brushes it was necessary to change the shape of the leads from the armature coil, as shown in Fig. 2, so that the throw of the leads is symmetrical with the center line of the coil. This located the brushes 45 deg. from the original position and directly behind the poles of the machine so that they would not be greatly influenced by the

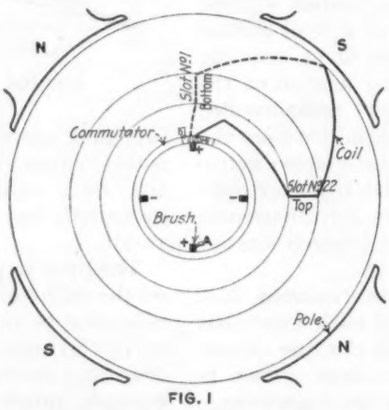


FIG. 1

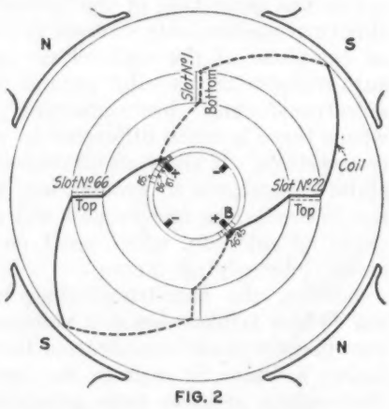


FIG. 2

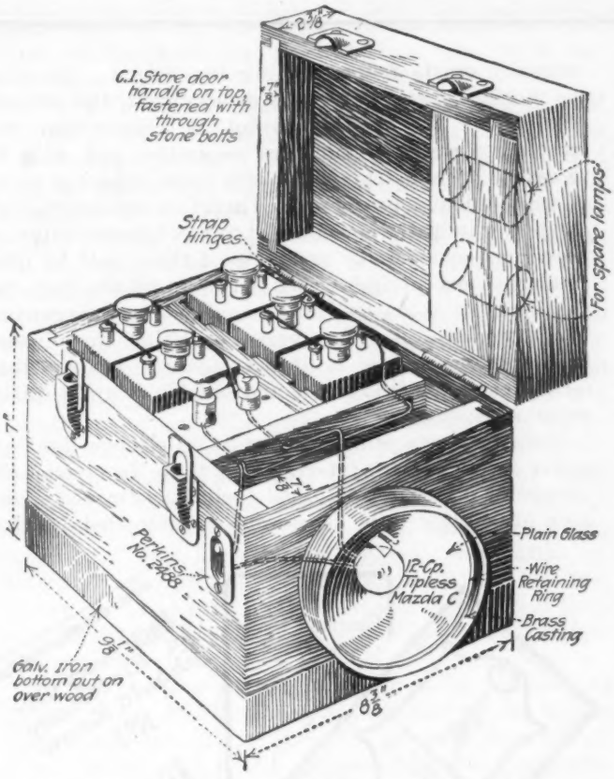
CHANGE MADE TO PREVENT ACCUMULATION OF OIL ON LOWEST BRUSH

draft. Since this change the motor has been in service for more than a year and no trouble from accumulation of oil on the brush holder has been experienced.

Bronx, N. Y. C. A. JOHNSON.

Portable Storage Battery Lamp for Very Damp Locations

PORTABLE storage-battery lamps suitable for use in any damp location, such as mines, etc., have been built by the city engineer's office in San Francisco. The lamp consists of a wooden box containing five


C.I. Store door handle on top, fastened with through stove bolts
Strap Hinges
For spare lamps
Plain Glass
Wire Retaining Ring
Brass Casting
12-Cp. Tipless Mazda C
Partition No. 2468
Galv. iron bottom put on over wood

LAMP MADE TO USE WHERE A GREAT DEAL OF MOISTURE IS PRESENT

storage cells and a 12-c.p. lamp attached to the box with a spun-metal reflector coated with white enamel. The cells were the Edison storage battery M-20, 12-amp.-hr. motor-cycle type with rubber insulation. After about a year's service from twelve of these lights it was found that the rubber-insulated cell was likely to give trouble. The boxes were sometimes tipped over and filled with water, and unless they were properly washed out and dried after such an accident, electrolysis made holes in the metal cell containers.

Accordingly, twenty-four lamps having the same type of cells were built, but without soft-rubber insulation. Hard-rubber buttons attached to the cells were used to hold the latter in grooves cut in the sides and partitions of the box. These lamps were provided with an automobile type of push-button switch mounted so as to be operated from the outside of the box. Binding posts of dissimilar character, which will fit only corresponding wire terminals, are used in charging. The dissimilarity of the terminals on the charging cord insures proper polarity. At first small motor-generator sets were used for this charging, but it was later found more desirable to connect the cells directly to the direct-current circuit in series with resistance units and a rheostat so that the current could be regulated to a strength of 2½ amp. for different numbers of cells connected in series. With this arrangement the charging of the cells is very simple and requires no expert attention.

The lamps are ordinarily used for three days' work without recharging. The set complete weighs 18 lb. (8 kg.), which is rather heavy, but it was thought worth while to make the box out of full 1-in. (2.5-cm.) material and to reinforce it as much as possible so that it would stand a great deal of abuse.

Floodlights for Buildings and Yards of Manufacturing Plants

THE method of floodlighting areas around the No. 1 nitrate plant at Sheffield, Ala., during the war period might well be employed for illuminating night construction work on other projects. The main portion of the plant, which included all the buildings with the exception of the Spring Creek pump house, the permanent community and the ammonium-nitrate buildings, was surrounded with a 7 ft. (2.1 m.) wire fence, and for guarding purposes the exterior of this fence was lighted by means of special-design flood-lighting projectors. These projectors were mounted approximately 10 ft. to 12 ft. (3 m. to 3.6 m.) above the ground and extended outside the fence a distance of about 4 ft. (1.2 m.). Each projector was fitted with a 400-watt lamp supplied by a series transformer on the pole having a winding on the secondary to produce 110 volts and a 6.6-amp. primary winding supplied from a constant-current transformer in the power house. A pole line was built around the property just inside the fence. A two-pin cross-arm carrying a No. 6 wire supplied the constant-current circuit. The projectors were spaced approximately 350 ft. (107 m.) apart, and each was equipped with a series of concentric and semi-circular plates which prevented rays getting inside the fence.

The idea was to leave no part of the outside of the fence unilluminated. The territory inside the fence would be comparatively dark so that the patrolling guards could not be seen. This system was supplied from a 10-kva., 2,300-volt, 6.6-amp. constant-current transformer operating independently of the street-lighting transformers.

Each building or small group of buildings was surrounded by an additional fence similar to the exterior fence, and standard 500-watt and 1,000-watt projectors were mounted on the buildings, illuminating the entire surrounding area. The projectors were pointed in such a way that the light directly around the walls and inside the fence would be less intense than the illumination on the fence. This was easily done by proper selection and location of projectors. In this manner the gas plant and the gas tanks were illuminated by means of projectors supplied from a constant-potential circuit operated by a single steel-inclosed switch in the gas house. Similarly the floodlighting on the machine shop was operated by a single switch inside the building. The process building was also surrounded by a fence and floodlights were placed on each side at a height of 50 ft. (15 m.), giving a good distribution for this purpose. Where buildings were close together, of course it was possible so to locate projectors as to cover the entire space between them without duplication.

C. D. GRAY AND E. HAGENLOCHER.
J. G. White Engineering Corporation,
New York.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Vancouver Appliance Sales Continue at High Rate

DURING the month of July six outside sales agents in the Vancouver district of the British Columbia Electric Railway Company made 1,478 calls and sold appliances of the value of $4,798.54. These appliances represented a load of 536 kw. and included six electric ranges. The total sales of the company during the month were 498 appliances, of which 222 were flatirons, 89 were electric grills and 50 were small cooking stoves. The British Columbia Electric Association, which is being formed among jobbers, contractor-dealers, retailers and central-station men, is expected to increase the sale of appliances in British Columbia materially.

Why Utilities Must Engage in a Good-Will Campaign

By George F. Oxley
Director of Publicity National Electric Light Association

SERVICE, efficient and immediately available whenever, wherever and in the fullest measure demanded, and at the lowest cost compatible with true efficiency, is the aim of the electric light and power industry. The electric utility executive has for his goal the maintenance of efficient twenty-four-hour service and the prompt extension of that service to all who desire it, at a price which will pay the cost of construction, maintenance and operation and yield to investors in his company's securities a fair return on their investments.

Everything possible has been done to this end by the electric light and power industry, as evidenced by the fact that during the ten years preceding the war the companies' charge per unit of service gradually was reduced an average of 25 per cent by the practice of economies and the fullest utilization of inventions and advances in science. In this the companies were assisted also by the greater use of electric service by the public. During the last five or six years increased costs have made necessary a slight upward trend of rates, but in far smaller ratio.

In the face of the greatest use ever made of existing plant equipment and transmission systems, an unprecedented demand for electric service exists throughout the country. Present users require more service, thousands of manufactories are insistent in their demands for service, as are rural communities also, so that at present the demand for electrical energy is approximately one-third greater than the available supply. In addition, fourteen million homes remain to be wired, exclusive of the four hundred thousand new homes which housing experts assert must be built at once.

Obviously, with so great an over-demand, an absolute necessity exists for increasing the output. To obtain the money necessary for this development, the industry must enter the money market in competition with national, state and municipal securities and with the securities of industries which have been enjoying an era of unprecedented prosperity. Therefore the electric light and power industry is compelled to pay interest rates and premiums considerably in excess of those paid by other securities, except industrials, in spite of the fact that the industry is basically as sound as the governments which regulate it. The very regulation that insures this soundness has militated against selling these securities at par because of unavoidable delay in raising rates sufficiently.

More than one million investors in electric light and power securities are interested in these facts from the viewpoint of the return upon their investment. Every user of electric light or power is interested in them

PUBLICITY FOLDERS USED IN CAMPAIGN TO INTEREST PUBLIC IN ELECTRICAL UTILITIES

from the viewpoint of the rates he must pay for service. The electric light and power industry has no source of income other than that collected in payment for service. If by reason of the fact that its rates are not sufficient to insure its securities selling at par value in competition with other securities, the industry must purchase the use of money at a discount, in which case a larger amount of securities would have to be sold. Interest must be paid upon the additional amount of securities sold, and that interest can come from only one source, the earnings of the company, which, after all, are governed by the rates charged the public for service. This same principle is true in every financial transaction of an electric light and power company. Any exorbitant tax imposed by the will of the people must be paid back by the people in the form of rates for service. If damage is done to the property of the company, that damage must be paid for and repairs made at the expense of the people using service. When

employees receive higher wages or the cost of coal increases the users of electrical service must pay.

This, then, is the situation of the electric light and power industry at present. Its service is in great demand. It must extend and expand its distribution systems and plants. To do this it must have money. To secure money it must have higher rates. To have higher rates it must have the sympathetic understanding and good will of the public. To have that the public must realize that its interests are one with the industry's.

It is with a full realization of these fundamental facts that the National Electric Light Association has inaugurated a good-will campaign, which it is hoped and expected will be the largest campaign of its kind ever undertaken by the industry. Through the medium of its "Kilo Watt" campaign, more than one million homes will be reached every month with a message, first, regarding the uses of electricity and on terminology of the electrical industry, and later regarding the problems of finance and operation. Through the public press and other popular magazines articles directed toward the same end already are appearing and will continue to appear during the year's campaign. Manufacturers of electrical machinery, equipment and appliances will devote a large part of their advertising space in national advertising mediums and in the smaller magazines and local newspapers to co-operation in this campaign. The Investment Bankers' Association of America is co-operating in the campaign and has prepared a series of pamphlets which will go out to at least five hundred thousand electrical industry security holders each month.

The sole purpose of the campaign is to endeavor to impress upon the public the fact that it is vitally interested in the electric light and power industry, just as the industry is vitally interested in the prosperity of the nation as a whole and as individual companies are interested in the prosperity of the communities they serve. When the public appreciates that the "capitalists" owning the electric light and power industry are in reality more than one million citizens of the United States, and when the public realizes that it can obtain cheaper and more efficient service by granting proper rates to the electric light and power industry—that is, rates which will permit the greatest possible development of the industry at the lowest possible cost—then the purpose of the campaign will have been served.

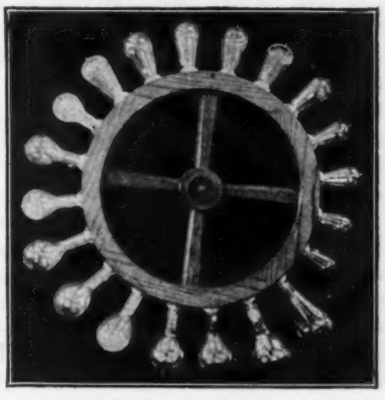
Power Rates Should Be Placed on Competitive Basis

POWER service is a competitive business rather than a public utility service, and central stations should therefore be allowed to make as much profit as they can out of their sale of power to large industrial concerns, according to Morse Dell Plain, vice-president and general manager of the Northern Indiana Gas & Electric Company and president of the Indiana Electric Light Association. In discussing this subject at the last convention of the association Mr. Dell Plain said that it would be to the advantage of the public at large if the central stations were allowed to charge as much for power service as the traffic would bear. The state public service commissions were instituted to regulate non-competitive service, but the power business that the utilities are now securing is strictly competitive with isolated-plant service, and in many instances it has been the central station rather than the power customer that needed the protection. When an industry is making large profits by the use of central-station energy there is no good reason why the utility should not make a good profit on the energy.

At the same convention E. I. Lewis, chairman of the Public Service Commission of Indiana, said "The central stations should advocate a high power rate in order that they may be in a position to supply reliable service and be able to keep ahead of the requirements of their growing communities. The public should be as anxious as the companies to have this condition prevail because adequate and reliable central-station service is the best asset a community can have. Continuous operation of public utility services which are supported by indirect taxation (rates) is more vital to the life and prosperity of a community than the public institutions and services for which the people are directly taxed." To illustrate his point, Mr. Lewis classed water, electricity, gas, street railways, telephone and interurbans among the services for which the public is taxed indirectly, and police, libraries, parks, schools, fire departments and courts as public services which are supported by direct taxation.

Time Saved in Selling Lamps

SINCE lamp manufacturers have adopted the practice of wrapping individual lamps in paper cartons and twisting the ends together, it has been difficult to show lamps to retail customers without considerable loss of time. In addition to the time lost unwrapping and rewrapping the carton, stocks frequently become mixed and disordered because of lamps being replaced on the wrong shelves.



WHEEL FOR DISPLAYING LAMPS

These difficulties have been overcome in the offices of the East St. Louis Light & Power Company by a lamp wheel as shown in the illustration. The wheel is 20 in. (51 cm.) in diameter and wide enough to permit a General Electric No. 3/0 receptacle to be countersunk into it. Twenty of these receptacles are mounted on the rim of the wheel. One side of each receptacle is wired to a common point inside the hub and the other side is connected to a segment of a device similar to a commutator. Energy is supplied to the wheel by means of brushes, and the brush on the commutator is wide enough to light two lamps at one time. The wiring and electrical connections are concealed in the wheel, and its support is mounted on the wall at a point convenient to the lamp counter. The lamps placed in the receptacles range in size from 10 watts to 100 watts of the types most frequently sold. Any individual lamp or two adjacent lamps can be lighted as desired. With these arrangements the comparative size, style and brilliancy of lamps can easily be shown to a customer and the order filled directly from stock.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generation, Transmission and Distribution

Factors in the Design of Large Boiler Plants—Part I.—J. GRADY ROLLOW.—A discussion of principal factors affecting equipment of boiler plants of large capacity. The following are said to be the points concerning which the engineer must have information in successfully designing boiler plants: (1) Character of the fuel to be used; (2) location of the plant with respect to fuel supply; (3) character of the water to be used as boiler feed; (4) size and character of the load to be carried; (5) distribution and use of steam; (6) cost and class of available labor and location of plant with respect to labor markets; (7) cost of fuel; (8) climatic conditions and altitude; (9) importance of the time element in getting plant either partially or wholly in operation; (10) local laws governing design and manufacture of pressure vessels, issuance of smoke, workmen's compensation acts, etc.; (11) the return expected on the capital invested; (12) permanence; (13) value of real estate.—*Electrical Review*, Aug. 21, 1920.

Developments in Power Plants and Generating Stations.—ALFRED STILL.—This is the third article of a series in which the author reviews the general tendencies in power-plant design, both hydro-electric and steam-electric.—*Electrical Review*, Aug. 21, 1920.

The Emmet Mercury Boiler.—The purpose of the mercury boiler and turbine is to make use of the high boiling point of mercury, 677 deg. Fahr. (360 deg. C.), its condensing point being 28 in. (711 mm.) vacuum and 465 deg. Fahr. (240 deg. C.). The exhaust from the mercury turbine is condensed in a form of surface condenser. The heat given out by the condensing mercury vapor makes steam of the cooling water, and this steam may be used to drive another turbine or for any other purpose for which steam may be required. The chief difficulties seem to be the large amount of mercury needed and the danger of leaks, as the mercury vapor is very poisonous. The mercury vapor is passed to the mercury turbine at about 10 lb. (0.7 kg. per sq.cm.) gage pressure. On account of the high temperature of the mercury in the boiler the flue gases leaving the tube are too hot to be passed directly to the stack. Therefore they are passed over a mercury preheater, over the steam superheater and finally over the feed-water heater or economizer. Mr. Emmet is said to believe that by the addition of the mercury device to a good modern power station, with an increase of 15 per cent in the amount of fuel used, the same amount of steam can be supplied to the steam turbines as under present conditions, and the mercury turbine will generate power equal to about 66 per cent of the power generated by the steam turbines. The experimental equipment was in operation for a short time last summer with over 1,000-kw. load on the mercury turbine, and its operation showed that the economies predicted were fully realized.—*Power*, Aug. 3, 1920.

Electrical Characteristics of the Suspension Insulator.—II.—F. W. PEEK, JR.—The author states that the old method of basing everything on electrical tests should be abandoned. Severe electrical tests are often harmful. An electrical, mechanical and porosity uniformity test should be established, in which a small percentage of the product is tested to destruction from day to day. For the very high voltages that are at present being considered greater reliability may in many respects be anticipated than for the lower-voltage lines. The lightning arc-over voltage and dielectric strength will be relatively higher and induced lightning voltages, sufficient to cause arc-over, will be less than now occur on low-voltage lines. Increasing the number of units in series also decreases the probability of complete string failure. Uneven distribution of voltage on the strings becomes more serious at the higher voltages because of the high stress on the unit near the line. This may be corrected by shielding, which prevents excessive corona on the line end units and tends to direct the power arc away from the string. The maximum unit stress on a 220-kv. shield string can be made less than on a 100-kv. non-shielded string.—*Journal A. I. E. E.*, July, 1920.

Traction

New Electric Locomotives.—The electric locomotives of the Gotthard and the Burgdorf-Thun are described in this article. The locomotives of the Gotthard railway, constructed by Brown, Boveri & Company, are for single-phase current, 15,000 volts, 16⅔ cycles. The body of the locomotive is supported by two trucks, each of which is provided with two series-connected motors, and the two groups of motors are fed in parallel. The regulation of the motors is obtained by changing the feeding pressure between 237 volts and 1,325 volts, with eighteen intervals, which is attained by means of suitable tappings in the secondary of the transformer. This is oil-cooled and rated at 1,730 kva. The two trolleys are of the pantograph shape. A small auxiliary group furnishing direct current, provided with accumulators, is employed for maneuvering the controller, for lighting, etc. The locomotives are provided with Westinghouse air and hand brakes; moreover, the motors can work as electric brakes for avoiding the formation of metallic dust from blocks and wheels, which has a serious effect on the motor windings. The locomotives for fast trains can develop a tractive effort of 300 tons upon an up-grade of 26 per 1,000 at 35 km. and 50 km. an hour; those for slow trains give the same effort at 50 km. an hour and an effort of 430 tons at 35 km. an hour. The new locomotives of the Burgdorf-Thun railway are for three-phase current, 750 volts, 40 cycles. The trolleys are of the bow type. The locomotive body is supported upon two trucks, each provided with a motor. To obtain four speeds the stators are provided with two independent windings, one giving

twelve and the other eight poles. The number of poles generated by each winding can be reduced to one-half by a star-delta connection. The rotors are short-circuited. Transformers with suitable tappings are used for starting the motors. The four wheels of each truck are coupled by two connecting rods. These are energized at their central points by two cranks, which receive their movement from an auxiliary shaft connected to the motor through a couple of gears of ratio one to six. The weight of the locomotive is 43.8 tons; the maximum weight of the train 200 tons.—*Science Abstracts, Section B*, July 30, 1920.

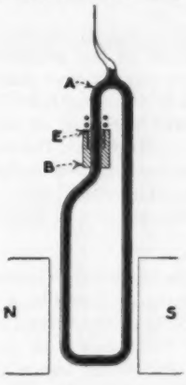
Installations, Systems and Appliances

Design of Contacts for Switches and Busbars.—W. HÖPP.—Extensive experimental researches on contact resistance between copper surfaces have led the author to a number of rules and relations important for proper design of contact surfaces. The current-carrying capacity of a contact is limited by the temperature rise, since at high temperature the losses rapidly increase from oxidation. Above a certain critical current very high temperatures are rapidly attained which tend to destroy the springs and necessitate frequent overhauling. These temperature phenomena are illustrated in a number of diagrams. The contact resistance between copper electrodes for practical cases was found to be almost entirely independent of the contact surface, being expressed as $R = \rho/P$, where P is the total contact pressure in kilograms and ρ is a constant, varying from 280 to 400 microhms per kilogram, for clean, solid contact pieces of copper, and taking values between 70 and 100 microhms per kilogram for similar contacts with tinned surfaces. The condition of a contact may easily be checked up at any time by measuring the drop for a given current. As an average for ordinary copper contacts the author suggests this formula: Drop in millivolts $= 0.5J/P$, J being the current in amperes. If a higher drop is found, either the contacts are very dirty or else the springs have given out so that the pressure no longer has the estimated value. In clamping two pieces of busbar together the contact resistance will add to the copper resistance, but the latter will tend to decrease, since the bar has twice the section in the overlap. Therefore it is possible to design the overlap so as to give the same total resistance as a solid bar of the given dimensions. Assuming an average screw-clamp pressure of 100 kg. per square centimeter, the author finds the necessary overlap to be independent of the thickness of the busbar and gives for all cases the overlap = 25 mm. (1 in.).—*Elektrotechnische Zeitschrift*, March 11 and 18, 1920.

Electrophysics and Magnetism

Magnetic Properties of Iron Alloys.—The series of articles on the relation of magnetic properties and electric conductivity of iron to its percentage of carbon, aluminum, silicon and manganese, etc., published by Gumlish and Goerens in the *Elektrotechnische Zeitschrift*, June 26 to July 24, and referred to in these columns on Feb. 14, is reprinted almost in full in the *Revue Générale d'Electricité* of May 1, 1920.

The Benedicks Thermo-Galvanic Effect.—GOUINEAU.—Some time ago (in *Comptes Rendus*, Vol. 166, 1920, p. 812), in the face of much scepticism, Carl Benedicks announced the discovery of a fourth thermo-galvanic effect having much the same relation to the Thomson effect as has the ordinary thermo-electric effect to the Peltier effect. According to Benedicks thermo-electromotive forces may arise in a perfectly homogeneous circuit of pure mercury, if the temperature distribution is unsymmetrical. The present author describes an experiment which seems to substantiate Benedicks' theories. Gouineau built a little galvanometer with a



APPARATUS TO DEMONSTRATE THE BENEDICKS THERMO-GALVANIC EFFECT

moving coil made up of mercury in a glass tube, as shown in the figure. At E the tube is drawn down to 0.1 mm. inside diameter. The mercury is heated electrically by a resistance spiral above E, while the lower part is kept cool by a protecting sleeve B of asbestos. Using a field strength of 2,000 gausses, deflections of 500 mm. were observed at 1,500 mm. scale distance, indicating that the sharp temperature gradient gives rise to an unbalanced electromotive force. The deflections changed direction when the field was reversed, and for zero field there was only 1 mm. or 2 mm. deflection.—*Comptes Rendus*, June 28, 1920.

Miscellaneous

The Problem of the World's Supply of Energy.—SVANTE AUGUST ARRHENIUS.—The writer deals with the general subject of the gradual exhaustion of coal supply and the question of substitute sources of energy when this is gone. He states that the United States is best off in the matter of coal, which should suffice for some 2,000 years, but England is in the worst position in this respect, with supply for less than 200 years. He also estimates that the coal in Germany will last for 1,000 years. The table gives water power resources of various nations and is attributed to Koehn and Keplan.

Continent	Horsepower in Millions	Horsepower per Inhabitant
Asia	236	0.27
Africa	160	0.14
North America	160	0.17
South America	94	5.25
Europe	65	0.13
Australia	30	3.75
Total	745	0.45 (average)

Country	Horsepower in Millions	Horsepower per Inhabitant
Canada	26	4
United States	100	1
Iceland	2	22
Norway	13	5.2
Sweden	6.7	1.2
Finland	2.6	0.8
Balkan Countries	10	0.6
Switzerland	1.5	0.4
Spain	5.2	0.26
Italy	5.5	0.15
France	6.0	0.15
Austria-Hungary	6.2	0.12
Germany	1.43	0.02
Great Britain	1.0	0.02
Russia	3.0	0.02

The writer also discusses the possibility of utilizing solar radiation.—*London Engineer*, Aug. 6, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

MODIFICATION of the Interstate Commerce Commission's service order No. 16, giving to public utilities the right to use assigned cars for their daily requirements, is being sought on the allegation that the order is being abused owing to the failure of the railroads to use due precautions in its observance.

A DETAILED outline of the program of the super-power survey was made by W. S. Murray, the engineer in charge at the first meeting of the advisory board. Herbert Hoover will represent the coal-mining industry on the board. The possibility of including the water powers of Maine was discussed.

A MERGER of the Marconi Wireless Telegraph Company of Canada and the wireless interests of the Canadian General Electric Company has just been announced, following the similar merger between the American Marconi Company and the wireless interests of the General Electric Company.

A CONTRACT for two 40,000-hp. hydraulic turbines and all generating equipment for the Fall River station No. 1 of the Pit River development has been let by the Pacific Gas & Electric Company of California.

MANY electric light and power companies are ordering large turbo-generators, the business being about equally divided between units above and units below 30,000 kw. rating.

CIRCUIT breakers rated at 1,500,000 kva. are to be installed in the Hell Gate station of the United Electric Light & Power Company, New York, to the number of 120. They are said to be the heaviest ever designed for 13,200-volt service.

AUTHORITATIVE announcement has been made that the Mexican government plans to purchase the extensive holdings of the Mexican Light & Power Company and the Mexican Tramways, Ltd., including the great hydro-electric plant at Necaxa, on which $12,000,000 gold was expended.

APPLICATIONS for licenses covering as much as 4,000,000 hp. will have been filed with the Federal Power Commission before Jan. 1, it is estimated. This will mean that an appropriation for the expenses of the commission much greater than the $100,000 carried by the bill must be made.

A STUDY into the physiological effects of direct and alternating current may be made a part of the Bureau of Standards' program next year.

PRICES of electrical material are reported as holding steady in all districts except New England, despite the general downward tendency on many commodities. A quiet market, however, prevails in most sections. Some lines in the Northwest are moving well. Disastrous forest fires have occurred on the Pacific Coast, and the high freight rates to the East have led several large lumber mills in the Northwest to threaten to close. The Alabama coal strike has affected adversely the fuel supply of the South. The transportation system generally is much better and stocks are more nearly normal, but except in the South construction of buildings is no more active.

GRADUAL rather than sharp price recessions have made their appearance among New England jobbers' quotations in response to improved deliveries and the desire to reduce surplus stocks or to avoid excessive accumulation.

ELECTRICAL engineering is being taught by the United States to 571 disabled former soldiers, and engineering of all kinds to 2,387.

PROPAGANDA to amend the water-power act in a way that will make the national parks absolutely safe is being carried on by the American Civic Association and the National Park Association. Such an amendment will be pushed by Senator Jones, the chairman of the Senate committee concerned.

WORCESTER, Mass., has held the largest electrical show in its history, the exhibition being entirely a local affair.

PLANS for the municipal operation of the light and power plant at Ash Grove, Mo., near St. Louis, have been formulated by the City Council. The city has an option on equipment of the present system, owned by W. R. B. Turner of Malden, Mo.

CHAIRMEN of the various sections of the Associated Manufacturers of Electrical Supplies have been elected for the ensuing year.

CONSUMERS buying energy from Doherty properties in Ohio at Massillon, Warren and Mansfield have aided in financing plant extensions.

ISSUES of 8 per cent preferred stock are announced by two large central-station companies. The total of bond and stock issues of such companies for September was more than $26,000,000. Very few short-term securities were offered.

A RECOMMENDATION that the inductive interference rules enforced in California be adopted by the public service commissions of other states was made by the inductive interference committee of the Technical Section of the N. E. L. A.

PRESIDENT BERRESFORD of the A. I. E. E. and President Insull of the N. E. L. A. addressed the Public Utilities Section of the National Safety Council at Chicago.

THE REPORT of the Bureau of Standards on its investigation of electrolysis conditions in St. Louis will be completed soon after the end of the investigations being made in Cleveland by the research sub-committee of the American Committee on Electrolysis, in which work the bureau is actively participating.

AFTER having inspected the electrification of railroads in the West, the Dutch commission on railroad electrification visited Washington. The commission was particularly interested in electrolysis and inductive interference.

BRITISH manufacturers and traders are, according to the Guaranty Trust Company of New York, determined to recapture the foreign trade that they lost to Germany before the war and to this end are both perfecting British trade interests in foreign lands and organizing industry more closely at home.

PROSPECTS for the lamp season are reported excellent and sales in 1920 are expected to surpass those in 1919 anywhere from 25 to 30 per cent.

MOTOR-DRIVEN appliances to the number of 2,000,000, it is estimated, will be produced in 1920, washing machines, ironing machines, dishwashers, vacuum cleaners, sewing machines and refrigerators being included.

ELECTRIC jobbers are finding household devices less profitable to handle than formerly, according to the views brought out at the meeting of the Electrical Supply Jobbers' Association at Chicago.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Modification of Utility Coal Priority Order Being Pressed

STRONG pressure is being exerted to obtain a further modification of the Interstate Commerce Commission's service order No. 16, which gives public utilities the right to use assigned cars for their daily requirements. It is claimed that the public utility order is being greatly abused, and admission is made that some abuses did occur under service order No. 9, which was the predecessor of No. 16. In fact, George W. Elliott, in charge of the Washington office of the National Committee on Gas and Electric Service, recommended the change which was made in order No. 16. In the latter order the utilities entitled to assigned cars are described closely. It is being alleged that the new order has had no effect on abuses and that the number of cars assigned to public utilities is increasing rapidly.

Mr. Elliott is of the opinion that the new order is entirely fair and should not be modified, even in lake territories. Owing to the length of time that is required for a new order to permeate to all employees of the railroad some time is required before restrictions become effective. While there may have been a continuance of some of the abuses of the old order during the first week that the new order was issued, Mr. Elliott believes that a marked decrease in the number of assigned cars going to public utilities will soon be noted.

Super-Power Zone Advisory Board Meets for First Time

INTENSE interest was manifest at the first meeting of the advisory board of the super-power survey, held in New York on Sept. 24. W. S. Murray, engineer in charge of the survey, had the opportunity to present to the board for the first time a general outline of his program with charts and to present his engineering staff as a whole.

It was announced that Herbert Hoover has accepted service on the board and will represent the coal-mining industry.

The object of the super-power system, Mr. Murray told the board, is the allocation of the amount of power waste and the recommendation of a regional plant by which it will be eliminated. Within the region covered by the system he estimated that there is a total of 17,000,000 hp. capacity, of which 10,000,000 hp. is in industries and electric public utilities and 7,000,000 hp. in steam railways. He then told how such a system would help transportation by greatly reducing coal haulage, increasing the average load factor from 15 per cent to about 50 per cent and saving 30,000,000 tons of coal annually due to a better steam consumption. Mr. Murray emphatically stated that he thought the entity and franchise rights of existing public utilities should be preserved and that the super-power system should in no way be considered competitive.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, voiced the opinion of all the other members of the board by saying that the super-power system must simply carry on on a larger scale the work that had already been started by the central stations. Mr. Edgar mentioned that he felt that the proper place for big power plants was not in the large cities.

A number of constructive suggestions were offered the engineering staff by different members of the advisory board. The work is going rapidly, and the members of the staff have now perfected plans for the ultimate co-ordination of the many phases of the work.

Need of Federal Power Commission for Larger Appropriation

APPLICATIONS for licenses covering as much as 4,000,000 hp. will have been filed with the Federal Power Commission before Jan. 1, it is estimated. This will mean that the commission will be called upon to handle in one year more water-power work than has been handled by the Departments of Agriculture, War and the Interior in the past fifteen years. An expenditure of approximately $250,000 annually has been necessitated for the work on water power done by those three departments. Therefore, it is pointed out, the Federal Power Commission must have greatly in excess of $100,000, its present appropriation. While it is virtually certain that Congress will promptly remedy the defect in the present law which prevents the use of any of the appropriation for the employment of an office force, it is recognized that difficulties will be encountered.

Manufacturers' Association Announces Fall Meetings

REGULAR fall meetings of the sections of the Associated Manufacturers of Electrical Supplies will be held during the week commencing Monday, Oct. 18, at the association rooms in New York City. The hours and specific dates for these meetings will be announced later. A meeting of the board of governors was held on Sept. 24. The board is outlining an additional line of activities and several new sections are contemplated.

At the meetings of the various sections held during the summer the following section chairmen were elected to serve for the ensuing year:

Air Circuit Breakers. — G. A. Burnham, Condit Electric Manufacturing Company, Boston, Mass.

Attachment Plugs.—A. H. Fleet, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Armored Conductor and Metallic Flexible Conduit.—G. F.

Holly, Youngstown Sheet & Tube Company, Youngstown, Ohio.

Carbon.—J. F. Kerlin, Corliss Carbon Company, Bradford, Pa.

Electrical Porcelain.—J. E. Way, R. Thomas & Sons Company, New York City.

Fan Motors.—Clinton Stark, Sprague Electric Works, New York City.

Fuses.—C. A. Bates, Bryant Electric Company, Bridgeport, Conn.

Heating Appliances.—F. D. Goode, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Industrial Lighting Fixtures.—W. D. Steele, Benjamin Electric Manufacturing Company, Chicago, Ill.

Knife Switches.—J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn.

Lamp Receptacles and Sockets.—H. R. Sargent, General Electric Company, Schenectady, N. Y.

Line Material.—Louis McCarthy, the Macallen Company, Boston, Mass.

Metal Molding.—C. E. Corrigan, National Metal Molding Company, Pittsburgh, Pa.

Molded or Formed Insulation.—Joseph Rockhill, General Insulate Company, Brooklyn, N. Y.

Non-Metallic Conduit.—Russel Dart, Alphaduct Company, Jersey City, N. J.

Outlet Boxes.—G. H. Sicard, Pratt-Chuck Company, Frankfort, N. Y.

Panelboards and Switchboards.—C. E. Wilson, Sprague Electric Works, New York City.

Signaling Apparatus.—T. W. Ness, Holtzer-Cabot Electric Company, Boston, Mass.

Snap Switches.—S. P. Williams, Hart & Hegeman Manufacturing Company, Hartford, Conn.

Wire and Cable.—Le Roy Clark, Safety Insulated Wire & Cable Company, New York City.

Rigid Conduit.—C. E. Corrigan, National Metal Molding Company, Pittsburgh, Pa.

No Very Short-Term Utility Financing Reported in September

ELECTRIC light and power public utility financing for September shows a total of $26,524,000. Ten million of the September total is in preferred stock at 8 per cent—$6,000,000 of the Philadelphia Electric Company and $4,000,000 of the Cleveland Electric Illuminating Company. Among the bond issues the shortest term is a five-year issue of $1,000,000 by the Puget Sound Power & Light Company which yields 8 per cent. The others are either ten-year or fifteen-year issues with two exceptions. One of these, $1,500,000 in gold bonds of the Northern States Power Company, falls due in 1941; the other, $2,304,000 in first mortgage bonds of the Kentucky & West Virginia Power Company, is to run for thirty years. This is in line with the tendency toward longer-term issues that has prevailed in the last few months. With the longer terms, however, there is no decline in interest rates. The average yield for September is as high as it has been this year. The issues are:

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Hartford Electric Light Co.	$5,000,000	10-year	Gold notes	7	7½	95.65
Philadelphia Electric Co.	6,000,000	.....	Preferred stock	8	8	25 (par)
Milwaukee Electric Railway & Light Co.	1,090,000	10-year	Sinking fund equipment trust gold certificates	8	8	par
Puget Sound Power & Light Co.	1,000,000	5-year	Gold coupon notes	8	8	par
Brooklyn Edison Company, Inc.	2,000,000	15-year dated Jan. 1, '20	General mortgage gold bonds	7	7½	93
Kentucky & West Virginia Power Co.	2,304,000	30-year	First mortgage gold bonds	7	7½	91.5
Cleveland Electric Illuminating Co.	4,000,000	.....	Preferred stock	8	8	par
Consumers' Power Co.	2,500,000	15-year	General and refunding mortgage gold bonds	7	8	91.25
Northern States Power Co.	1,500,000	25-year due Apr. 1, 1941	First and refunding mortgage gold bonds	6	7.40	85
Scranton Electric Co.	1,000,000	10-year	Secured gold bonds	8	8.06	99.50
Mobile Electric Co.	130,000	10-year	Secured gold notes	8	8½	98½

California Inductive Interference Rules Recommended as Basis

RECOMMENDATION that the California rules be adopted as a basis by the North Dakota Utilities Commission, and that wherever possible rules similar to those of California be adopted by all other state commissions in dealing with the inductive interference problem, was made by the inductive interference committee of the Technical Section of the N. E. L. A. at its Chicago meeting last week.

The safety committee meeting at the same time recommended that the *National Safety Code*, 1920 edition, be adopted by state commissions in preference to the adoption of individual state codes. It was pointed out by the committee that in so doing, state commissions could protect themselves and the local companies by the customary "saving clauses" and that the adoption of these rules would place them in actual practice so that the practical observation of their working during the coming year would form a basis for desired changes.

Berresford Declares Combination of Fire and Safety Codes Impracticable

PRESIDENTS of the two largest electrical associations, Martin J. Insull of the National Electric Light Association and A. W. Berresford of the American Institute of Electrical Engineers, addressed the members of the Public Utilities Section of the National Safety Council at a luncheon at Milwaukee, Wis., on Tuesday during the ninth annual convention, which was in session Monday to Friday of this week. Speaking from a personal viewpoint and not officially, Mr. Berresford called attention to the dangers of code making without proper consideration of the fundamentals involved or proper consultation with those whose standing gives them authority to speak for the industries involved. It was his opinion that the proposed combination of the fire and electrical safety codes is commercially impracticable as the fire code deals fundamentally with commercial hazards, elimination of which is a question determined largely by cost, while the safety code deals with life hazards, where cost is not a prime factor.

Mr. Insull pointed out how safety work can interest employees in utility management problems. He expressed the belief that much of the labor unrest is an expression of a desire for recognition and that the day is not far distant when employee participation in management must be expected. Sympathy with commissions in their handling of utility problems and confidence in their fairness and that of the public were expressed.

The sessions of the Public Utilities Section occupied Tuesday and Wednesday mornings, and papers dealing with hazards in line, underground and power-plant construction were presented.

North Dakota Commission Adopts Overhead-Line Rules

AT A meeting of the Railroad Commissioners at Bismarck, N. D., on Sept. 13-14, it was decided to adopt the National Electrical Safety Code for North Dakota in so far as it affects overhead-line construction. The 1920 edition with its revisions will be used in preference to the 1916 edition. It is reported that the commission has adopted the California inductive interference rules also, because under an existing state law rules had to be adopted within a definite time, and the California rules were taken as the best available.

Central-Station Companies Are Again Issuing Preferred Stock

TWO large issues of 8 per cent cumulative preferred stock have just been put on the market by electrical supply companies. The Cleveland Electric Illuminating Company offers $4,000,000, and the Philadelphia Electric Company offers $6,000,000 of an authorized issue of $15,000,000, both at par.

The Mobile (Ala.) Electric Company advertises an issue of ten-year bond-secured 8 per cent gold notes to the amount of $130,000, convertible into 7 per cent preferred stock of the company, at 97 and dividends for the stock and at par and interest for the notes.

Two bond issues by central-station companies are also announced. The Consumers' Power Company, operating in lower Michigan, offers $2,500,000 fifteen-year 7 per cent gold bonds at 91¼ and interest to yield more than 8 per cent. The Scranton Electric Company offers $1,000,000 of ten-year 8 per cent gold bonds at 99½ and interest.

Many Companies Ordering Large Compound Turbo-Generators

THE Westinghouse Electric & Manufacturing Company announces that it has received within the past three months orders from electric light and power companies for more than 500,000 hp. of turbo-generators.

Among these orders are the following:

Cheswick Power Company, Pittsburgh, Pa., one compound unit of 60,000 kw., which will be one of the largest engines ever built.

Narragansett Electric Lighting Company, Providence, R. I., one compound unit of 45,000 kw.

United Electric Light & Power Company, New York, two compound units of 35,000 kw. each.

Brooklyn (N. Y.) Edison Company, two single units of 25,000 kw. each.

United Electric Company, Springfield, Mass., a single unit of 25,000 kw.

Commonwealth Edison Company, Chicago, one compound unit of 35,000 kw.

Havana (Cuba) Electric Railway Company, two single units of 25,000 kw. each.

Commenting on the sale of these large steam turbines, E. H. Sniffin, manager of the power department, Westinghouse Electric & Manufacturing Company, pointed out that the business in large turbine units was about equally divided, as to number, between units of over 30,000 kw. and units of under 30,000 kw. rating. Owing to the reliability of the multi-cylinder type, he stated, it is believed that it eliminates many problems of design which would occur, owing to the physical dimensions, with the single cylinder in these very large sizes. From the present knowledge of design it appears, according to Mr. Sniffin, that this will continue to be the case for some time to come, but, of course, definite prediction cannot be made on account of the rapid development in the industry.

Ohio Consumers Finance Plant Extensions

HIGH interest rates of the present time have caused several utilities in Ohio to seek aid in financing plant extensions from their larger consumers, such as manufacturing plants in need of additional power supplies. The Massillon (Ohio) Electric & Gas Company extended its plant by the addition of a turbine and boilers at a cost of approximately $250,000, of which $200,000 was financed by the consumers at 6 per cent on a five-year basis. The Trumbull Public Service Company, Warren, Ohio, obtained approximately $300,000 from its consumers, and the Richland Public Service Company, Mansfield, Ohio, obtained $200,000, both of these transactions being upon substantially the same terms as those obtained at Massillon. These are Doherty companies.

Two 40,000 Hp. Waterwheels Ordered by Pacific Gas & Electric

CONTRACT has just been let by the Pacific Gas & Electric Company for two 40,000-hp. single-runner, vertical-shaft hydraulic turbines and all generating equipment for the Fall River station No. 1 of its Pit River development in California. These units will operate on a 425-ft. (139.5-m.) head, and will have the largest rating of all waterwheels in the United States. The rest of the generating equipment consists of two 35,000-kva. waterwheel generators for 90 per cent lagging power factor, three-phase, 60 cycles, 11,000 volts, 257 r.p.m., with direct-connected exciters, and one 225-kw. motor-generator set. Allis-Chalmers will supply all the generating equipment, which represents an investment of about $1,000,000, while Westinghouse will supply the seven transformers, which are single-phase, 16,667-kva., oil-insulated, water-cooled, outdoor type, wound for 127,000 volts high-tension and star-connected for 220,000 volts.

Propaganda to Amend Water-Power Bill So as to Protect National Parks

THE American Civic Association has joined the National Park Association in sending out statements to the effect that since the passage of the water-power act "no single square foot of national park, reservation, or even cemetery, is safe from the claims of the power promoter if it has on it a drop of water."

The Federal Power Commission announced immediately upon its organization that no applications would be granted for projects in the national parks. It is well known that Senator Jones, the chairman of the Senate committee having jurisdiction over such matters, is pledged to do all in his power to have the act amended at the next session so as to exclude from its purview any national parks. It is regarded as probable, however, that the amendment will carry a provision for a resurvey of the national parks looking to the exclusion from their boundaries of such areas as do not possess scenic value.

N. E. L. A. Hydraulic Power Committee Formally Organized

THE new hydraulic power committee which was established at the Pasadena convention of the National Electric Light Association was formally organized during the convention of the Northwest Electric Light and Power Association at Spokane on Sept. 8. Markham Cheever of the Utah Power & Light Company of Salt Lake City is the chairman. In order not to conflict with any other committees of technical societies or to duplicate their work, this new N. E. L. A. committee will concern itself with the operating features of hydraulic turbines, etc., exclusively.

Circuit Breakers Rated at 1,500,000 Kva.

THE heaviest circuit breakers ever designed for 13,200-volt service will be installed by the United Electric Light & Power Company, New York, in its Hell Gate Station. There will be 120 of these solenoid-operated type "04" Westinghouse circuit breakers having an interrupting rating of 58,000 amp. at the arc, or 1,500,000 kva. The normal rating is 3,000 amp. The disconnecting switches are gang-operated and their operating mechanisms are interlocked with the oil-breaker mechanism, so that the disconnecting switches cannot be moved unless the breaker is not in operating position, thus assuring safety to operators.

These oil circuit breakers are unique in that the phase elements will be in separate rooms approximately 30 ft. (9 m.) apart, with the operating mechanism on the floor above, thereby preventing the possibility of a busbar short circuit and minimizing the effects of a ground.

Utility Securities Show Improvement During Past Week

THAT utility securities have shown improvement during the past week is the opinion of D. C. Johnson, utility expert of the National City Company. Although it is improbable that the cost of financing will decrease in the near future, it would seem that the maximum has been reached.

"Utilities," said Mr. Johnson, "are recognizing that high interest rates will prevail for some years, and as a result there is more of a tendency to issue longer term securities, that is, from ten-year to twenty-year maturities. Short-term notes and debentures which must be refunded at the end of two or three years cost the utilities from 8.5 to 10 per cent and even higher, while it is now possible for a utility of the first grade to issue ten-year to twenty-year securities on an 8 to 9 per cent basis. The advantage of the longer term securities is obvious, and as they are callable at a relatively small premium the companies can readily refinance an issue."

Eastern Jobbers Discuss Conditions in Appliance Market

GOOD attendance of members and a comprehensive program of timely interest marked the meeting of the Atlantic Division of the Electrical Supply Jobbers' Association in Philadelphia on Sept. 23. How the growth and development of electrical heating devices have become possible through the use of alloyed metals covered by the Marsh patent was told by C. A. Payne of the General Electric Company.

The advertising plan of the publicity committee, which was explained in the ELECTRICAL WORLD last week, was presented by A. A. Gray, publicity counsel. Ways in which the manufacturer can co-operate to increase the stock turnover of his distributers were discussed by W. B. Pierce of the Edison Electric Appliance Company. That the present market situation is changing from a sellers' to a buyers' market was the opinion of Raymond Marsh of the Syracuse Washing Machine Corporation in talking on the merchandising of electrical clothes-washing machines and the outlook.

T. H. West, Philadelphia Electric Company, pointed out that business is passing through a period of readjustment due to overexpansion of credit and advocated present conservatism in making increases in capacity.

Jobbers' Volume of Business 60 per Cent Above That of Last Year

COST of doing business was the principal subject discussed at the regular meeting of the Central Division of the Electrical Supply Jobbers' Association held in Chicago on Sept. 24. Thirty-six members reported on the volume of business for the first eight months of this year compared with the same period last year and every one showed an increase, the smallest being 24 per cent, the largest 117 per cent and the average 64.68 per cent. Since the first of the year, however, inventories and accounts receivable have increased while gross profits have decreased.

The necessity for prompt collections at the present time was emphasized in an address by W. S. Bissell of the F. Bissell Company, Toledo, Ohio.

A very full discussion on the cost of marketing motor-driven household devices was led by F. D. Van Winkle of the Post-Glover Electric Company, Cincinnati, Ohio.

Empire State Gas and Electric Association Meets at Utica Oct. 7-8

FOR its sixteenth annual convention, which will be held at the Hotel Utica, Utica, N. Y., on Oct. 7 and 8, the Empire State Gas and Electric Association has prepared the following program:

THURSDAY, OCT. 7

Morning—Address of President Horace L. Mann; "Selling in a Small Community," by H. K. Stein, superintendent Genesee Light & Power Company, Batavia, N. Y.; "Importance of Meter Testing," by F. J. Murmann, superintendent of meters Westchester Lighting Company, Mount Vernon, N. Y.; "Service Charge Rate," by A. Parshall, consulting engineer, Rochester, N. Y.

Afternoon—"Financing Utility Properties," by R. M. Searle, president Rochester (N. Y.) Gas & Electric Corporation; "Consumers' Viewpoint," by G. I. Vincent, engineer Syracuse (N. Y.) Lighting Company; "Newspaper Viewpoint," by George M. Smith, managing editor New York *Tribune*.

FRIDAY, OCT. 8

Morning—"Coal Situation," by G. N. Snider, coal traffic manager New York Central Railroad; "Office Location, Arrangement and Upkeep," by S. J. Magee, vice-president Associated Gas & Electric Company, New York City; "Office Work in a Small Company," by Paul B. Murphy, treasurer Potsdam (N. Y.) Electric Light & Power Company; election of officers.

An entertainment program has been arranged, including a dinner on Thursday evening and golf and an automobile trip on Friday afternoon.

Straight Rate Better than Combination, in Opinion of Michigan Company

CONTENDING that a straight rate based on the kilowatt-hours consumed is better understood by its consumers than the combination rate based on connected load plus an energy charge now in effect, the Consumers' Power Company has applied to the Grand Rapids (Mich.) City Commission for a change in rates. The 8-cent straight rate asked will give an increased return in addition to simplifying the schedule. Other rates under consideration involve changes in the present combination rate.

Electrical Engineering Taught by Nation to 571 Disabled Ex-Service Men

A TOTAL of 571 disabled ex-service men are taking courses in electrical engineering at the expense of the Federal Board for Vocational Education. These courses are being pursued in a number of schools teaching electrical engineering in each section of the country. The institutions used for the education of these former soldiers include nine schools in Massachusetts, five in New York City, five at other points in New York, twelve in Pennsylvania, six in Ohio, six in Illinois, three in Indiana, three in Tennessee, three in Michigan, three in Iowa, three in Kansas, three in Missouri, three in Colorado, ten in California and three in Oklahoma. In addition one or two schools in the following states have been designated: New Hampshire, Vermont, New Jersey, Connecticut, District of Columbia, Maryland, Virginia, Georgia, North Carolina, Alabama, Mississippi, Louisiana, Kentucky, Wisconsin, Nebraska, Minnesota, Montana, New Mexico, Utah, Arizona, Oregon, Washington and Texas. In all the Federal Board for Vocational Education has 2,387 persons taking engineering courses.

Federal Ownership Program of Mexico Causes Surprise

FOREIGN investment interests in Mexico express much surprise at the authoritative announcement which has just come from the capital to the effect that the Mexican government plans to purchase the extensive holdings of the Mexican Light & Power Company and the Mexican Tramways, Ltd., including the great hydro-electric plant at Necaxa. It is stated that an inventory of these properties has just been made and that the proposed purchase price has been practically agreed upon by the interests involved. The making public of the government's plans to acquire these holdings was all the more of a surprise, coming, as it did, upon the heels of an authentic statement that the Mexican Tramways, Ltd., had under consideration plans for resuming construction work upon its two proposed interurban electric lines, one to run from the city of Mexico to Puebla, 130 miles, and the other from the city of Mexico to Toluca, 45 miles. More than $12,000,000 gold was expended in the building of dams for the storage of water in the mountains, the installation of a hydro-electric plant of 200,000 hp. and the construction of transmission lines from Necaxa to the city of Mexico, Puebla and El Oro. How much money in addition to this was invested in the lighting system and street railways of the capital and Puebla is not publicly known. The Mexican Light & Power Company and the Mexican Tramways, Ltd., are owned by a British syndicate.

It is the purpose of the Mexican government to finance these pending transactions by issuing bonds, which will be retired from the profits of the companies. The details of how this financing is to be accomplished are lacking, however, in the preliminary announcement of pending negotiations.

Merger of Canadian General Electric and Marconi Radio Interests

ANNOUNCEMENT was made at Montreal on Sept. 16 of the merger of the Marconi Wireless Telegraph Company of Canada, Ltd., with the wireless interests of the Canadian General Electric Company. Directors of the latter company, including Senator Nicholls, Sir William MacKenzie and A. E. Dyment of Toronto, have been elected to the board of the Marconi company, which now has the following directors: Frederic Nicholls, president; William Marconi, A. E. Dyment and Robert Bickerdike, vice-presidents; Sir William MacKenzie, Godfrey C. Isaacs, G. M. Bosworth, C. G. Greenshields, and A. H. Morse, managing director. Plans involved in the reorganization call for an increase in the authorized capital of the company to provide additional working funds and for the acquisition of valuable patents controlled by the Canadian General Electric Company.

This merger follows upon the similar merger effected some months ago in the United States between the American Marconi Company and the wireless interests of the General Electric Company, the consolidated company being known as the Radio Corporation of America. The Canadian allied interests were not included in the American merger because the Canadian patents of General Electric wireless equipments are owned in Canada by the Canadian General Electric Company, Ltd., which is a separate corporation not under the control of the American General Electric Company.

Staff of Society for Electrical Development Holds Weekly Conferences

IN ORDER to insure close co-operation between the different departments of the Society for Electrical Development and to co-ordinate its efforts with a view to securing the maximum results, a weekly conference is held by the members of the staff who are responsible for the various activities. At these conferences the work of the society is planned. If the plans are for any extensive activity, they are submitted to the executive committee for approval.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Reasonable Rates for Street Lighting.—Annual rates per lamp for electric street lighting of $23 for 80-cp. lamps and $40.25 for 250-cp. lamps have been declared by the Missouri Public Service Commission to be reasonable charges in the city of Liberty, upon comparison with the rates in other localities.

Extensions to Municipal Plants in New Jersey.—Municipal plants do not, under the New Jersey statutes, the Board of Public Utility Commissioners has declared, require the consent of the commission for additions and extensions not made in contemplation of the supplying of service outside of the limits of the municipality.

Increase in Rates Must Be Earned.—In denying an application for increased gas rates made by the Central Illinois Public Service Company, the Illinois Public Utilities Commission declared that such a company, although not earning a fair return, is not entitled to retain an increase in rates where the increase was granted solely upon the condition that the utility would improve the service rendered and where it had not made a reasonable effort to comply with the requirements as to service nor made any attempt to show why service had not been improved.

Reparation for Rates Alleged to Have Been Excessive.—Application was filed before the Pennsylvania Public Service Commission by the borough of Tyrone asking that the Home Electric Light & Steam Heating Company be made to refund alleged excessive charges made before a modification of its rates by the commission. The commission held that the claim for damages was predicated upon a tariff under which the utility did not derive adequate revenue, the readjustment having been made to obtain a better distribution of the burden, and that therefore no reparation could be ordered in spite of the cancellation of the schedule about which complaint was made.

Arkansas Corporation Commission Approves Return of 7.4 per Cent.—Granting an application from the Rogers Light & Water Company for an advance in electric rates, the Arkansas Corporation Commission asserted that a reproduction value based on a ten-year average of costs previous to 1920 was more equitable than a valuation based on prevailing prices, that a 7.4 per cent return on the investment in a combined water and electric plant met with its approval, and that in the belief of the commission the first duty of a utility is to render service and the only way in which a utlity can render adequate service is to obtain a sufficient rate.

Refusal to Permit Rates to Vary with Cost.—The New Jersey Board of Public Utility Commissioners has refused in a gas-company rate case to approve a charge varying with the cost of the product, upon the ground that the resulting uncertainty to the consumer as to the price to be charged would make it impracticable and probably cause much confusion and annoyance.

Distinction Between Night and Continuous Electric Service.—Asked by the Virginia Western Power Company to prescribe the character of service to be rendered by it in the city of Clifton Forge, the Virginia State Corporation Commission refused, holding that the city itself should decide upon the kind of service. The commission asserted its possession of power to prescribe the rates for twenty-four-hour service rendered by the electric company, although the latter's franchise definitely fixes rates for service from sunset to sunrise, since continuous service is essentially different and distinct from night service and cannot be considered as having been embraced within the terms of the franchise. The city, however, could not be compelled to accept such service against its wishes where the franchise granted by it to the company provided for service from sunset to sunrise only.

Abnormal Conditions in Relation to Extensions.—A real estate company having complained that the Union Electric Light & Power Company of St. Louis had refused to make extensions to its property, the Missouri Public Service Commission, in view of the abnormal financial conditions confronting utilities, approved an arrangement by which the utility would finance the extension to each of three residences concerned up to $50 and the consumer would deposit with the utility the amount of the estimated excess cost thereof subject to the following rebates: (1) A refund of one-half the monthly bills for service up to the full amount of the "normal costs," provided such refunds within the first forty-eight months of service equal said normal costs; or (2) a refund up to the total consumer deposit under (a) a guaranty by the consumer that the annual revenue therefrom shall equal 40 per cent of the actual cost, whereupon that portion of the annual revenue in excess of 20 per cent shall be refunded until the total amount of the deposit has been refunded, the company deducting any deficiency in annual guaranteed revenue from the consumer's deposit, or (b) a refund of $30 for each new resident or commercial lighting consumer and $150 for each new commercial power consumer secured on the extension within the first five years after its completion.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contributory Negligence Not a Factor Where Lineman Climbs Rotten Pole in Course of Duty.—The Supreme Court of Missouri has held, in State ex rel. City of St. Joseph, that the lower court was not in error in instructing that a lineman who was injured when he climbed a rotten pole on orders from his foreman was not guilty of contributory negligence, and that inasmuch as the condition of the pole was or with ordinary care could have been known to the city or the foreman, negligence on their part was established. (223 S. W. 671.)*

State and Municipal Functions.—While, according to the Supreme Court of Appeals of West Virginia, in City of Charleston vs. Public Service Commission, there may be circumstances under which a state may, in matters of proprietary right as distinguished from those phases of the police power relating to the public safety, health and morals, authorize a municipality to establish by inviolable contract the conditions and rates governing rendition of service by a public service corporation for a definite term not grossly unreasonable in duration, yet since the inevitable result of such a contract is to foreclose the right to exercise an important government function, the authority so to restrict state power must clearly appear and any doubt must be resolved in favor of the continuance of the power. (103 S. E. 673.)

Right to Construct Tunnel at Niagara Sustained.—In an action brought by the Hydraulic Power Company of Niagara Falls against two manufacturing companies which sought to restrain the construction under their properties of a tunnel to convey and utilize waste waters which had previously been used by the defendants for generating electricity, the Supreme Court of New York held that the right to build such a tunnel, acquired in 1900, had not been lost by laches because construction was not started until 1914, and that the defendants having accepted the benefits of the agreement for fourteen years could not by refusing to file objection to the plans or to enter into arbitration concerning them prevent the building of the tunnel, the provision for arbitration on objection being merely incidental and not such as to interfere with the performance of the substantive part of the agreement. (183 N. Y. S. 373.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Energy Consumption in Italy.—The total consumption of electrical energy in Italy for 1918-19 was 3,743,285,194 kw.-hr., as compared with a total of 2,311,930,347 kw.-hr. five years previously.

Electrification of Brazilian Railroads.—A report made by the United States Consul at Rio de Janeiro says that a credit of about $11,000,000 has been authorized by the Brazilian government to cover the cost of changing the railroad system from steam to electricity on the state-owned suburban lines from Rio de Janeiro to Deodoro, Barra do Pirahy, Santa Cruz, Paracomby and Maritima. Plans for the prolongation of some or all lines to the center of the city are also under way.

Adelaide, Australia, Turns to Water Power.—Two plans to derive electrical energy from water power are now under consideration by the South Australian government for application to the city of Adelaide. One plan is to harness the water power from the Square Waterhole, 37 miles from Adelaide, and the second is to use the water of the Myponga River. By taking the water underground from the Square Waterhole and retaining it in a storage basin it is calculated that 21,000 hp. could be obtained all the year round. The other project is expected to provide 42,000 hp., which would be sufficient to supply electricity to all the tramways, the suburban railways, the Islington workshops and for lighting and industrial purposes in the metropolitan area. The cost of the two schemes is put at £1,000,000.

United States Supplies India with Equipment.—The Andira Valley Power Supply Company of India, which is establishing two large central stations at Bhivpuri and Mahin, 90 miles inland from Bombay, has purchased 207 carloads of electrical equipment from the General Electric Company. Shipments have covered an extended period, says the *Schenectady Works News*, 100 carloads having been sent from Schenectady, thirty-five from Pittsfield and twelve from Lynn. Sixty carloads of transformer oil were also included. The largest items were three alternators having a total weight of 580,000 lb., five condensers with a combined weight of 160,000 lb. and two motor-generator sets. The total weight of the shipment was 80,000 tons. Some of the heaviest lifts between Bombay and the destination will be made by means of elephants. The shippers had to take into account the rainy season of India, where from May to September 240 inches of rain frequently falls, making heavy transportation impossible. The assembling of this power station equipment will consume months.

East African Water Power.—The government of Uganda, British East Africa, will grant a concession for the right to develop a portion of the Ripon Falls, near Jinja, for the purpose of generating and distributing electricity for lighting and power in the surrounding district. The Ripon Falls are the outlet from Victoria Nyanza to the Upper Nile, forming one of the sources to the River Nile proper. They are three in number, and the river at the point of the falls is about three-quarters of a mile wide. The average quantity of water passing over the falls is about 20,000 cu.ft. a second.

Progress on Queenston-Chippawa Power Canal.—Reviewing the progress made by the Hydro-Electric Power Commission of Ontario in the construction of the Queenston-Chippawa power canal in connection with its Niagara developments, the *Canadian Engineer* reports the situation to be as follows: The excavation for the forebay has been completed; approximately half of the total excavation necessary for the entire work has been finished; the power-house site has been cleared and excavations for foundations have begun; the construction railway from Queenston has been built and is in operation, and three of the concrete-arch bridges to span the canal have been constructed. Two million dollars' worth of additional construction equipment has been purchased in the last year. It is confidently expected that power from this plant will be delivered before the end of 1921.

Chapter of Accidents Due to Careless Construction.—Because, apparently, of careless construction and lack of adequate inspection of power and telephone lines, one fatality and many accidents were caused near Caro, Mich., recently by a short circuit of which *Telephony* gives an account. The trouble started through the contact of a 2,000-volt line of the Caro Light & Power Company with the limb of a tree. The wires burned in two and the dangling ends dropped onto the lines of two telephone companies which were directly beneath them. Five miles further along the wires of one of these telephone companies were crossed with the wires of a third telephone company because a farm-service branch wire had been allowed to sag upon them. The 2,000 volts from the power line burned off the insulation of this drop line and set fire to a farmhouse connected with it. A young man passing in an automobile endeavored to extinguish the fire and was killed by the telephone wire, which he attacked with a broom, falling upon him, and his father in trying to rescue him was severely hurt. Meanwhile numerous telephone subscribers had received shocks and operators of local exchanges had been driven from their switchboards.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Chicago.—This club has resumed its meetings for the fall and winter season, meeting on Tuesdays.

Florida Ice and Public Utilities Association.—The next regular meeting of this association will be held at Miami on Nov. 15 and 16, partly in conjunction with the meeting of the Southeastern Geographic Division, N. E. L. A.

Philadelphia Section, A. I. and S. E. E.—The first meeting of the new association year of this section will be held tonight (Oct. 2), when J. R. Penman of the Reading (Pa.) Iron Company will give an address on "Electrical Features of Mechanical Puddling."

Water-Power League of America.—This association will convene at Washington, D. C., on Oct. 7 and 8 for the purpose of affording "an opportunity to the several states that are interested in water power development to have their representatives come in contact with the Federal Power Commission that there may be evolved a workable program which will co-ordinate the activities in those states with that of the federal government."

St. Louis Electrical Board of Trade.—The officers, chairman and members of standing committees of the St. Louis Electrical Board of Trade for the coming year were presented to the members of that organization on Sept. 14 at a banquet held at the American Annex Hotel. The officers presented were President C. E. Michel, First Vice-President H. N. Goodell, Second Vice-President H. D. McBride, Treasurer Frank B. Adams and Secretary E. J. Spencer.

Coming Meetings of Electrical and Other Technical Societies

Illuminating Engineering Society — Cleveland, Oct. 4-7. (For program see issue of Aug. 14, page 349.)
National Association of Electrical Contractors and Dealers—Baltimore, Oct. 4-9. (For program see issue of Sept. 25, page 655.)
Electric Furnace Association—Columbus, Ohio, Oct. 6.
American Electric Railway Association—Atantic City, N. J., Oct. 11-15.
National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.
British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 19.
International Association of Municipal Electricians—New Orleans, Oct. 19-22.
Association of Railway Electrical Engineers—Chicago, Oct. 28-31.
Electrical Supply Jobbers' Association—Cleveland, date in November to be fixed.
American Engineering Council — Washington, D. C., Nov. 18-20. (For program see issue of Sept. 25, page 651.)
Electric Power Club—Hot Springs, Va., Nov. 15-18.
Southeastern Geographic Division, N. E. L. A.—Miami, Fla., Nov. 17-19.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. B. Harvey, the newly elected president of the Nebraska Section of the National Electric Light Association, has been prominent in Nebraska utility work for a number of years. He started in 1902-1904 as a telephone lineman, rising to a superintendency. In 1904 he entered the State University at Lincoln, graduating in 1909 after completing the electrical engineering course and taking a post-graduate course in mechanical engineering. He was in the employ of the street-railway company in Omaha during his summer vacations and after his graduation superintended the erection of its new

J. B. HARVEY

power house, and he was electrical engineer for that company when he left to organize the Aurora Electric Company at Aurora, Neb. This project was financed locally, and Mr. Harvey built the plant and system, which was merged in 1913 with the Continental Gas & Electric Company. He remained with the new company as manager of the Nebraska group, which consisted of Aurora, York and Beatrice. In 1918 Mr. Harvey as vice-president and F. H. Brooks as general manager took charge of the entire group, which now comprises eighty-seven towns in Nebraska and Iowa and the electric and gas property at Brandon, Manitoba. Mr. Harvey has organized the Public Service Company as the operating company of the group and also the Electric Transmission Company, which built the first transmission line in Nebraska. Mr. Harvey has been the vice-president of the Nebraska Section of the National Electric Light Association, and has brought a typical Western spirit of progress into the work.

Charles S. Ruffner, vice-president of the American Institute of Electrical Engineers and vice-president of the North American Company, New York, has been appointed chairman of the traction and transportation committee of the American Institute of Electrical Engineers, succeeding W. S. Murray.

F. V. Magalhaes, superintendent of the meter and test departments of the New York Edison Company, has been appointed chairman of the instruments and measurements committee of the American Institute of Electrical Engineers, succeeding S. G. Rhodes.

Charles E. Patterson, comptroller of the General Electric Company since 1913, has been elected vice-president in charge of accounting. Mr. Patterson was previously associated with the New York Central Railroad and the American Locomotive Company. For nearly twenty-five years he has had wide experience in accounting. He aided in the development of the Interstate Commerce Commission's accounting system for railways and was appointed chairman of the standing committee of the Electrical Manufacturers' Council, which evolved the standard accounting cost system for the electrical manufacturing industry—a system which received the approval of the Federal Trade Commission and has been generally adopted by electrical manufacturing companies. As secretary to one of the officials of the New York Central, Mr. Patterson began the study of accounting which led to his elevation to the position of assistant comptroller. In 1901 he became comptroller of the American Locomotive Company. In 1909 he joined the General Electric Company for the purpose of introducing a modern accounting system. In 1913 he was elected comptroller of the General Electric Company. His present

C. E. PATTERSON

responsibilities include supervision of credit and collections and the financial relations with subsidiary companies. Mr. Patterson was born in New York City in 1866 and was graduated from Princeton University.

George E. Lewis, the president-elect of the Michigan Section of the National Electric Light Association, is a graduate of the engineering department of the University of Michigan. During 1909 he was associated with the S. Morgan Smith Company at York, Pa. In 1910 he went to Ann Arbor, Mich., with the Eastern Michigan Edison Company as local superintendent. He was advanced to the position of division superintendent in 1912 and in 1915 became superintendent of hydraulic plants of the Detroit Edison Company. He is also associated with Gardner S. Williams, consulting engineer, as electrical

G. E. LEWIS

engineer. He is a member of the American Institute of Electrical Engineers and a past chairman of the Detroit-Ann Arbor Section of the Institute. Mr. Lewis has been active in Michigan association affairs, being the first vice-president for 1919-20.

Russell G. Carter has been promoted to superintendent of the Belfast district of the Penobscot Bay Electric Company, Bucksport, Me., succeeding H. K. Brodgett, who has been transferred to the Rockland district for the same company.

Markham Cheever, chief engineer and general superintendent of the Utah Power & Light Company, has been appointed chairman of the new hydraulic power committee of the National Electric Light Association, which is largely a Western committee and will be active in the interests of hydro-electric developments. Mr. Cheever was born at Ann Arbor, Mich., May 19, 1880, and was graduated from the engineering department of the University of Michigan in 1903. In that year he joined the engineering staff of the Ontario Power Company at Niagara Falls, which was actively engaged in construction work. In 1906 he became associated with the Telluride Power Company in the San Juan district of Colorado; then, after a short period in Idaho, he went to Utah, where he has been connected with the Utah Power & Light Company on engineering work since 1912.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Price Guarantee Question to Be Threshed Out

INSTANCES multiply where jobbers and dealers who are inclined to buy conservatively in lines where prices are high have asked electrical manufacturers for guarantees against declining markets. A case in point has just come to notice in the West where jobbers are not buying certain electric appliances because they expect prices to fall. They are requesting that the manufacturers protect them against a drop in price. In the East the practice is also growing. Only a month ago a large electrical manufacturing company announced that it would guarantee its jobbers against price declines for a period of sixty days after the purchase of goods.

This is interesting in view of the action of the Federal Trade Commission in calling for a hearing on the subject of price guarantees, to be held in Washington on Oct. 5. The commission received so many complaints relative to guaranteed prices that it decided to hold a "trade practice submittal" on the matter. The latter is an informal hearing which all those in an industry or groups of interested industries may attend to discuss the merits and demerits of business practices against which complaints have been made to the commission. The findings of the meeting are generally taken as the expression of the trade in the matter under consideration.

In this case the objection against guaranteeing prices seems to be that it is said to sustain prices unnaturally. Once a manufacturer has guaranteed a certain price he is naturally loath to reduce its level. When this occurs on articles where the element of monopoly is a factor, or where several manufacturers are acting in concert, it is held to be an infringement of the Lever act against profiteering. There are many who uphold the practice, however, on the grounds that it is a legitimate regulation of a firm's own business.

The Federal Trade Commission as a preliminary to considering the matter recently sent out 2,000 questionnaires to ascertain the views of purchasers, manufacturers, and retail and wholesale dealers, representing more than fifty major lines of industry. Included among these was the electrical industry. The general returns from the questionnaires showed that 250 of those replying favored the practice of giving price guarantees, while 150 answers were opposed. A large number of replies were received with noncommittal or qualified opinions.

Lamp Sales of 1920 Expected to Surpass 1919 from 25 to 30 per Cent

PROSPECTS for a good lamp season this fall are excellent, according to information received from the leading lamp producers. Sales thus far this year have been greatly in excess of other seasons, it is reported, and a still greater volume of business is expected to materialize from now on. One of the large manufacturers of lamps says the demand this season has constantly been in excess of the company's ability to turn out goods and that the sales billed thus far have been 50 per cent in excess of last year. Another manufacturer found demand 25 per cent ahead of the estimated figures for the first four months of 1920, while the next four months have closely followed predicted sales. This company expects fall business to follow the estimated sales curve which is placed about 20 to 30 per cent higher than 1919. To supply this demand, conditions are not so favorable. Factory stocks are either very low or else short on certain sizes. One company has a fairly good stock of "B" lamps, both in warehouses and with jobbers and dealers. On the "C" type, on the other hand, production in this instance has been running considerably below the current demand and no new stock has accumulated. This manufacturer expects its jobbers to be short on these lamps, but is hopeful of increasing production sufficiently to clean up unfilled orders by the first of the year. Another producer reports that in spite of its own low level of lamp stocks the supplies of its distributers are in good shape. Miniature lamps seem to be in good supply both at the factory and with jobbers. Shipments of these are made from stock up to two days' time, according to a leading maker, and miniature-lamp agents are even over-stocked in some cases. Shipments of large lamps not in stock can generally be made in from two to six weeks except on "type C" lamps. Deliveries of these are slower in some cases, one manufacturer being from two to three months behind on orders.

Raw material is not causing any great difficulty at present, it is said, except on some of the minor items. No trouble is being experienced with labor either, though one of the large producing interests recently reported great difficulty in obtaining sufficient skilled workmen. Cancellations are said to be negligible at present. Production is proceeding at a brisk rate. In nearly all cases the output seems to be well up to normal, and one manufacturer is turning out 30 per cent more lamps than last year. Collection conditions are good in this line. The average time of paying bills ranges from thirty to thirty-five days.

British Manufacturers Endeavoring to Regain World Trade

BRITISH manufacturers and traders are determined to recapture the trade won from them in pre-war days by the Germans and to strengthen their hold in foreign markets, according to a report issued by the Guaranty Trust Company of New York. This end is to be accomplished in two ways—first by the perfecting and enlarging of British trade interests in foreign countries, and secondly by the closer organization and consolidation of industry at home. The latter method is intended to bring about better methods of production and sales.

The foreign trade department of the British government formed in 1918, and known as the Department of Overseas Trade, has, it is stated, given particular attention to the need of closer association among manufacturers as a means of strengthening British trade. The committee on electrical trade of the foreign trade department, investigating the condition of the electrical industry after the war, laid particular stress on this matter in its report. The committee said: "Only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations, which not only manufacture but undertake comprehensive contracts, make powerful financial alliances, and thus exert in every direction greater influence than is possible in the case of any individual firm." Similar views were expressed of the iron and steel and the engineering trades.

A committee of the British Board of Trade, investigating the export trade of the country with the object of devising methods to meet the severe commercial competition that

was anticipated after the war, also recommended in February, 1918, that electrical manufacturers among others should form a common selling organization by the extension and consolidation of existing associations, the organization to be divided into groups handling specific products. That the danger of uncontrolled monopolies and combines is also recognized, however, is evident in the recommendations of the committee on industrial and commercial policy. This committee stated that it would be desirable to institute in the United Kingdom machinery for the investigation of the operation of monopolies, trusts and combines similar to the commissions and other tribunals created for that purpose in the United States.

A typical example of the method by which the British plan to recapture their overseas trade, according to the report of the Guaranty Trust Company of New York, is the organization known as the British Trade Corporation, incorporated in 1917, with an authorized capital of £10,000,000, of which £2,000,000 is fully paid up. Since its incorporation this company has facilitated the export of goods of many millions of pounds value.

In conjunction with the London and Westminster, Lloyd's and the National Provincial banks, the British Trade Corporation formed the South Russia Banking Agency. It also has an investment in the Portuguese Trade Corporation, which was specially started to compete with German interests. Another subsidiary is the Anglo-Brazilian Commercial and Agency Company, which has opened branch houses in Brazil, especially at places where German influence in the past was strongest. Another undertaking in which the British Trade Corporation has invested is the Levant Company, Ltd., which seems to have a promising future as the representative of British influence in the Near East. In this connection the British Trade Corporation has acquired the entire capital stock of the National Bank of Turkey.

Output of Motor-Driven Appliances in 1920 Estimated at 2,000,000 Units

DURING the past year or two the growth in sales of motor-driven household appliances has been very large, and as a result considerable interest has been manifest in statistics of sales in this field, which includes washing machines, ironing machines, dishwashers, vacuum cleaners, electric sewing machines and electric refrigerators. Estimates of the volume of business done in these fields naturally differ somewhat. According to an article by Bernard Lester, in the September issue of the *Circle*, house organ of Westinghouse Electric & Manufacturing Company, the total sales in these six classes of appliances will amount to approximately $170,000,000 during 1920. This estimate is based upon the retail selling price. The business is divided about as follows:

	No. of Units	Retail Price
Washing machines	800,000	$100,000,000
Ironing machines	50,000	7,500,000
Dishwashers	20,000	2,200,000
Vacuum cleaners	1,000,000	53,000,000
Electric refrigerators	10,000	3,250,000
Electric sewing machines	75,000	4,500,000
Total	1,955,000	$170,450,000

An interesting feature of the article is a chart showing the growth by years in the sales of motor-driven appliances. No longer ago than 1916 the total number of electric vacuum cleaners sold yearly was only 100,000. In 1917 the figures advanced to 175,000 and they rose to 750,000 in 1919. The estimate for 1920 is 1,000,000 cleaners. The growth of electric washing machine sales has been quite as rapid. In 1916 only 150,000 of these machines were sold and this number advanced to 475,000 in 1919. The total for this year should reach 800,000, it is stated. The remaining fields are as yet practically undeveloped. Sales of electric sewing machines of any considerable amount date back only to 1915. Total sales for 1920 are estimated at but 100,000 machines. Electric ironing machines, dishwashers and refrigerators can trace their commercial growth only as far back as 1916. Annual sales of ironing machines have as yet reached a total of only about 50,000, and of dishwashers and refrigerators considerably less than 25,000. A large growth of business in these appliances is anticipated.

Canada Turns Out $30,000,000 of Electrical Apparatus

INFORMATION recently published by the Dominion Bureau of Statistics at Ottawa, Canada, would indicate that the manufacture of electrical apparatus has reached important proportions in that country. The requirements of the various electrical plants are now being more largely supplied by the Canadian manufacturers, although imports are still very large, according to a preliminary report issued by the Bureau of Statistics containing figures compiled for the year 1918. Since that date there is little doubt that considerable progress has been made by electrical manufacturers in meeting the demands made upon them in connection with the numerous developments of water power which are now under way throughout the Dominion. In 1918 there were sixty-eight plants engaged in the manufacture of electrical apparatus. The total capitalization of the industry was $43,285,405 and 8,863 persons were employed. The selling value of the articles produced at the works during that year is given as follows:

Dynamos, generators and converters	$1,503,443
Transformers	2,291,874
Switchboards, panelboards and cabinets	990,898
Motors of all kinds	2,727,673
Storage batteries	212,624
Primary batteries	1,397,635
Incandescent lamps	1,924,745
Sockets, receptacles, bases, etc.	415,855
Lighting fixtures	311,844
Telegraph apparatus	71,230
Telephone transmitters	50,000
Telephone receivers	95,000
Interior telephone systems	444,000
Telephone central switchboards	750,000
Private telephone exchange boards	110,000
Insulated wire and cable	5,154,984
All other electrical machinery	1,738,085
Carbons	1,362,666
All other miscellaneous products	8,492,843
Total value	$30,045,399

Exports of electrical apparatus by Canadian manufacturers during the past fiscal year ended March 31, 1920, amounted to only $301,932 (of which $159,788 was for batteries, telephone and telegraph apparatus and $142,144 for electrical apparatus not otherwise provided for), which total is a decrease from $2,167,545 in 1918-19 and $2,166,961 in the previous year.

Need of Co-operation Among Jobbers

AFTER being long handicapped by depleted stocks, electrical jobbers are now confronted with the problem of handling steadily increasing inventories at a time when most merchants, manufacturers and bankers believe that stocks should be reduced. This is very difficult for jobbers to accomplish, however, because manufacturers are catching up with back orders, freight is being handled more expeditiously, and many contractors, dealers and industrial customers have canceled orders which jobbers had already made arrangements to fill.

Jobbers themselves have canceled some orders, it is true, but a number of manufacturers who sell through jobbers state that they have had a smaller percentage of business canceled than have their competitors who sell direct to dealers and consumers through agents.

In a number of places electrical supply jobbers have been trying to solve the problem of uneven stocks by exchanging with competitors. This method has been found to work out well for more than one reason. It helps the one to protect his customers with an adequate supply of materials which otherwise he would be short on. It helps the other to reduce his stock to a sane level, thereby making his financial position more desirable. Moreover, it helps to prevent dumping of excess stocks and so badly disarranging the market when there is no sound economic reason.

Metal Market Situation

Business in the copper market continues dull. There is not enough demand to establish a firm basis for prices and as a result quotations are but nominal. Producers are shading prices as low as 18.50, it is reported. A drop of 1 cent per pound is noted on copper wire base. In the outside market sales are also light. Second hands are offering holdings at 18 cents for nearby shipment and from ¼ to ½ cent higher for delivery through November and December. A sharp break in the London market forced standard spot copper down £3¼ the past week.

Incoming shipments of foreign lead continue to feature that market. The "official" price at New York has been dropped ½ cent per pound. The scrap metals market is virtually stagnant. Weakness in copper prices and lack of demand caused lower quotations on old copper and brass, while prices on scrap zinc and lead also receded.

NEW YORK METAL MARKET PRICES

	September 21	September 28
Copper	£ s d	£ s d
London, standard spot	87 0 0	93 10 0
	Cents per Pound	Cents per Pound
Prime Lake	18.50–18.62½	18.50–18.62½
Electrolytic	18.75	18.50–18.75
Casting	17.75	17.62½
Wire base	22.50–23.00	21.50–22.00
Lead, trust price	8.50	8.00
Antimony	7.12½	7.12½
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.12½	7.75– 8.00
Tin	44.50	43.50
Aluminum, 98 to 99 per cent	35.10	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50–15.75	15.25–15.50
Brass, heavy	9.00– 9.25	8.50– 9.00
Brass, light	7.00– 7.25	6.50– 7.00
Lead, heavy	7.00– 7.25	6.50– 6.75
Zinc, old scrap	5.00– 5.25	4.50– 5.00

THE WEEK
IN TRADE

IN SPITE of the general downward price tendency on many commodities, prices of electrical material are reported as holding steady in all districts except New England, where weakness in several items is noted.

Quietness is still the prevailing feature of the electrical market in most sections. New England reports brisk trade, however, and in the Northwest a few lines are moving more briskly. The remainder of the country is apparently resting on its oars awaiting price developments. Jobbers on the West Coast fear the result which price reductions in the automobile industry and other lines may have upon business. In the Northwest several large lumber mills are expected to close as a result of transcontinental carriers refusing to modify freight rates upon lumber shipped to the East. The Pacific Coast reports the occurrence of several disastrous fires. In the South a shortage of fuel threatens as a result of the strike of Alabama coal mines.

The transportation situation is very greatly relieved. Stocks are returning to normal and shortages are being reduced. Some complaint is still heard regarding the supply of motors, outlet boxes and rigid conduit. A good volume of construction work is under way in the South, but building activity in other districts is decidedly off as the result of high labor, scarcity of material and tightness of money.

NEW YORK

Recessions in prices of commodities and materials during the past week have not as yet been reflected in the electrical trade, but the causes of the recessions in the other fields are present in the electrical field. Builders are holding off to watch the progress of the price changes, and this has slowed the usual fall demand, which should be strong at this time. With the expected state housing laws not materializing and without definite statements as to future price policy from the steel mills, building here will be confined necessarily to small extensions. Steel products, such as conduit, have further tightened owing to the embargo on carload or less lots of freight from Pittsburgh. Credits and collections show no material change. Transportation is generally slowly improving. Shipments of poles and crossarms from the Pacific Coast are beginning to come through.

Weatherproof Wire.—Base price remains at 28 cents with delivery fair. Foreign demand depends on settlement of exchange.

Line Material.—The usual fall demand is not up to standard. More shipments are coming through than orders require. Insulator orders are taken on long-term delivery, as filling depends largely on transportation.

Poles and Cross-Arms.—Stocks of poles are not improving. Supplies of cross-arms are better, but demand is light. The only price changes have been the addition of the increased freight rates.

Small Motors.—Demand is weak and stocks are being held down.

Rigid Conduit.—Uncertainty of steel costs, poor transportation from Pittsburgh east and the fact that production is far behind have held conduit stocks at a very low point. Black, ½-in., is quoted from $90 to $103 per 1,000 ft.

Flexible Armored Conductor.—Stocks are plentiful, with prices ranging from $85 to $95 per 1,000 ft.

Household Appliances.—Demand is falling off in most lines, such as heaters, vacuum cleaners, dishwashers and hollow ware. Some jobbers report increased washing-machine sales.

Schedule Material.—The market generally is tight with only a few items such as pull sockets good. The Benjamin Electric Manufacturing Company has increased prices on porcelain sockets, including its copper-cap line, from 12 to 38 per cent, averaging 25 per cent.

Dry Cells.—Since the recent advance in price there has been a noticeable increase in sales of bell-ringing transformers for house service.

CHICAGO

While business in general seems to be in a state of flux due to price decreases in many lines, everything in the electrical line is holding steady. The conservative basis of electrical prices and of the merchandising methods established in this line has justified itself by preserving the industry from the nervousness and excitement suffered by others.

Little or no reflection of the current unrest has been felt by dealers or jobbers in this section, and no demands for price cutting have been heard. Orders and inquiries have maintained their steady pace. Shipments from manufacturers are coming in steadily and stocks are gradually returning to normal. In every way trade seems to be progressing in a normal manner. This does not mean that no price reductions are to be expected. As raw material and production costs decrease through the general price recession the prices of finished products are expected to decline in the electrical trade. Manufacturers and jobbers in this district, however, have not been making a profit sufficiently large to occasion price cutting until such cuts are justified by reduced costs.

During the past few days there have been some instances of intended price increases being canceled. Manufacturers feel that while the contemplated increases are justified immediate relief may be in sight and that it is best to give customers the benefit of the doubt until costs in the near future may be seen more clearly.

Wire.—With copper prices slightly off and with cotton and other insulating materials declining, the outlook is for lower prices on both bare and covered wire. It is too soon for any change to be recorded yet, and demand is steady at old prices.

Fractional Motors.—Production is said to be exceeding market consumption by some 20,000 units per week, which seems to discount the possibility of any price advance. The Emerson Electric Manufacturing Company announces that prices will be withdrawn at the expiration of existing fan motor contracts on Sept. 31. What the new prices will be is not yet known.

Heating Devices.—Jobbers' and retailers' sales are above the September average. Stock conditions are improved in these devices. Local demand for heaters, particularly of the single-unit type, is quite heavy. Jobbers anticipate their best seasonal record this fall and winter.

Household Appliances.—Much talk has been heard recently about threatened increases in washer and vacuum-cleaner prices. If the present lower trend in raw material cost prevails the increases will probably be averted. Local and rural demand in this district is being maintained surprisingly well.

BOSTON

Jobbers report that trade continues brisk. Deliveries are improving except on rigid conduit and motors. Prices have weakened on flexible-armored conductor, porcelain knobs and tubes, rubber-covered wire and floor lamps. Collections show some improvement, but are closely watched. In manufacturing circles labor engaged on electrical products continues to function more satisfactorily than for some time. Wiremen in the Boston district, however, have requested a flat increase in their hourly rate from $1.50 to $2, making a normal day's pay $12. It is unlikely that the employing contractors will concede any such increase.

Jobbers' stocks are being well maintained by the receipt of long-deferred rail shipments. Building and engineering contracts in New England for the first three weeks in September totaled $15,661,000, compared with $17,302,000 for the same period last year. The high cost of labor and the unwillingness of men in many trades to work intensively, combined with scarcity of building materials, has slowed down many new building projects.

Rubber-Covered Wire.—In 5,000-ft. lots No. 14 is quoted as low as $10.75 to $10.85 per 1,000 ft., with special prices on large orders of 25,000 ft. or over. Stocks are plentiful with fair demand.

Weatherproof Wire.—Current buying is around 31 cents per pound, with six to eight weeks' delivery from the factory. Stocks are low.

Tubes.—Prices are easier, 3-in. tubes being quoted at $11.35 per 1,000 in. barrel lots, net. "Nail-it" knobs are also lower, a representative price being $34.65 per 1,000 in barrel lots. The arrival of long-deferred consignments is a factor in these quotations.

Flexible-Armored Conductor.—The price tendency is downward under close competition. In coil lots up to 1,000 ft. the price is about $110 per 1,000 ft., and about $100 in larger quantities. Stocks are substantial, with a medium demand.

Rigid Conduit.—Supplies are short and such small stocks as exist are very spotty. Quotations from jobbers' stocks are following card 45 pretty closely, but on mill shipments price at time of delivery is quoted. No trouble is encountered in disposing of any canceled orders left on hand. Little is heard as to price reductions, and in some quarters further advances are regarded as likely.

Motors.—The outlook for shorter deliveries is not good. Three-phase motors of 1 hp. to 10 hp. are quoted on about forty weeks' delivery by one leading house, and on sizes of 15 hp. to 100 hp., twenty-four weeks are quoted. Small direct-current motors are hard to obtain, and the second-hand market is constantly being scoured for "casuals." Prices are firm.

Radiators.—For the moment jobbers are well stocked against the fall demand, but it is doubtful whether a shortage can be avoided when cold weather arrives. One large manufacturer is but a few days behind orders because of foresighted production last summer. Prices are firm, list less 25 per cent being quoted to dealers on lots of six, with 5 to 10 per cent more off on lots of thirty.

Non-Metallic Flexible Conduit.—Despite a heavy demand no shortage is reported. Prices are steady, the $\frac{3}{8}$-in. size selling for $33.50 per 1,000 ft. in 5,000-ft. lots and the $\frac{1}{2}$-in. size for $35 to $36.

Floor Lamps.—Price cutting is under way in retail circles, owing to the accumulation of stocks.

ATLANTA

Conditions throughout the cotton belt have been very satisfactory for cotton picking, and ginning has got under way. Business for the past fortnight has been somewhat quiet as compared with August but will be considerably accelerated as soon as the new cotton crop goes on the market. Ready funds in the rural districts at the present time are very low. The recent break in lumber prices has stimulated building activities, and permits for Atlanta through Sept. 22 are valued at $980,000, an amount double that for the same period in August. Most of this construction is of the commercial and moderate dwelling class, no large office buildings or industrial plants being included.

Jobbers report considerable improvement in the transportation situation. The most noticeable feature is the great reduction in the number of lost shipments, a situation that caused no little trouble in the late spring and summer. The strike of the coal miners in Alabama bids fair to cause an acute shortage of fuel for both industrial and domestic purposes unless the difficulties between miners and operators are very quickly adjusted.

The announcement of the governor of the Sixth Federal Reserve District Bank that the Reserve banks would continue to rediscount warehouse paper to provide for the orderly handling of the cotton crop has done much to lend a more optimistic tone to rural districts. Collections, however, continue tight and credit extensions have been cut approximately 50 per cent.

Knife Switches.—The inroads made by safety switches on sales are very noticeable. All sizes with the exception of 30-amp., 60-amp. and 100-amp., two-wire and three-wire types, are moving very slowly. Stocks are reported in good condition with shipments above the average. Prices, $50 to $200 lots, 30-amp., two-wire, 96 cents; 60-amp., two-wire, $1.62; 100-amp., two-wire, $3.30.

Schedule Material.—Recent receipts have enabled most jobbers to make good headway in filling back orders and accumulating fair stocks. Porcelain has shown an encouraging improvement and is coming through more satisfactorily than for some time past. Orders on all lines of schedule material show a tendency to slow up.

Bells, Buzzers and Annunciators.—A price advance of 25 per cent in the line of specialties is announced. The entire line shows an excellent demand in spite of this increase. While present stocks are fair, unsatisfactory shipments are causing considerable depletion in the more popular articles.

Poles.—Improvement in transportation is responsible for better deliveries of poles. Demand is very brisk. A 30-ft. Western red cedar, butt-treated pole is quoted at $15.20; 35-ft., $23.90, f.o.b. Atlanta; Southern white cedar, one-half the above price. The latter type of pole is showing unusual activity because of the big difference in price.

Cross-Arms.—A large increase in orders has been reported the last two weeks, the principal gain being on orders for standard arms. Stocks of fir arms are somewhat shot up and spotty, while shipments continue only fair. Stocks of pine arms are very badly depleted. Prices, fir arms, less than 1,000 linear ft., two-pin, 3-ft., 79 cents; four-pin, 4-ft., $1.09; N.E.L.A. arms, two-pin, 3-ft., $1.18; four-pin, 5½-ft., $1.78.

ST. LOUIS

The past week has been a continuation of the quiet that has prevailed in electrical circles during September. Some jobbers report that so far as new business is concerned it has been the poorest week experienced in some time. Other jobbers are not so pessimistic, but at the present rate September's volume of business will be considerably below that for August. Distributers attribute much of this quiet to

the psychological effect of the country-wide price reductions. They look for greatly improved business after the election in November. Neither manufacturers nor jobbers in this section are expecting price decreases in electrical lines.

Jobbers' stocks are in good condition except on a few lines such as holiday toys and magnet wire. Good transportation conditions in this territory are having their effect on supplies. Retail sales have been slow the past week. The fall business in heating devices has not developed as yet, but dealers look for the first touch of cold weather to improve demand. Collections remain slow and are being pushed.

Building in St. Louis proper is almost at a standstill, both for industrial and residence purposes, and very little construction work is expected until spring. Home building in suburban territory is more active and electrical contractors are getting a number of smaller jobs in adjacent district.

Poles.—Jobbers report a good stock at base points but are having some difficulty in obtaining cars for shipment. Where cars can be secured deliveries of any sized order can be made. Demand at present is good and is coming more from railroads than from utilities. The latter are buying just enough to cover winter requirements and to finish construction jobs under way. Base prices at mill quoted here range from $11.35 on a Western cedar 8-in., 40-ft. pole to $20 on a Northern white cedar 8-in. 40-ft. pole. Prices are net plus freight from base.

Fuses.—Jobbers report a good demand, especially for the renewable type. Stocks of both renewable and standard fuses are good. Prices show an upward tendency, "Economy" fuses having advanced 27 per cent in packages of 200.

Sockets.—Stocks are large owing to small demand and recent large shipments from manufacturers. The dearth of fixture business, caused by cessation of building, is responsible for the slow demand. Pulls are quoted at 51 cents, keys at 28 cents and keyless at 26 cents, net, in case lots.

Holiday Toys.—Most jobbers in this district have decided not to handle this line at all. As a result there is practically no stock here. Retailers are buying direct in most cases and have placed good orders. Deliveries are not being made as yet.

Meters.—Stocks of the house type are decidedly spotty. Demand from central stations is good because of the large amount of house remodeling and wiring going on. Factories are promising deliveries about the first of the year. By the time building construction becomes normal jobbers' stocks will be built up.

SEATTLE—PORTLAND

With the exception of a noticeable increase in the movement of socket devices, certain heating appliances and lamps, sales are light and indications are they will remain so for a considerable period. Residence construction is maintaining a comparatively even level, but commercial building is very quiet. Apparently there will be no immediate readjustment of lumber rates from the Northwest to Eastern destinations, according to traffic officials of the transcontinental railroads. As a result it is reported that many important mills in both Oregon and Washington will close. Orders for lumber are slackening off.

Business in the Portland district continues good. Production is improving owing more to the increased facilities of manufacturers than to the decrease in demand. The shortage of meters continues and no immediate relief is in sight. Jobbers state that the pole-line material and the loom shortage have been relieved. Recent receipt of several cars of washing machines and electric ranges has also replenished stocks. Wire is in good shape at present, but stocks of steel boxes and covers are short and no relief is in sight. Contractors report fair business. Competition is keen on larger work. Collections are still slow. Dealers report exceptionally good business.

SAN FRANCISCO

Conditions remain about the same with good average business. There is increased expectancy of a serious change in the near future, however, since the recent dropping of automobile prices. Large contractors are working full crews. There is an especially good amount of marine work. The smaller contractors, on the other hand, are finding that there are fewer small jobs on which to figure and so are working only a few men.

There have been a number of disastrous fires in California this year, several small towns having been practically wiped out. A recent fire in Sacramento destroyed the entire season's fruit pack of the California Packing Company. The loss is estimated at $4,000,000.

Batteries.—Stocks and deliveries are good, but demand is being hit by many factors. Considerable missionary work is devoted to the sale of packed combinations of batteries.

Sewing Machines.—Supply is far in excess of the demand. The price advances made during the past three months bringing vibrating machines to more than $60 and rotary machines to more than $80 are undoubtedly justified but have killed demand.

Radiators.—Advance orders taken last winter are being filled. The Westinghouse Electric & Manufacturing Company has notified such dealers that their future delivery orders will be filled immediately because of threatened price advances and probable shortage of stock.

Electric Ranges.—The Pacific Gas & Electric Company has issued a schedule which provides that its agents will sell ranges and water heaters at published list prices, with fixed additions for installation. The new range rate is 3½ cents per kilowatt-hour for the first 180 kw.-hr. and 2 cents thereafter on a two-meter schedule, or else a sliding scale that enables the average household to reach the 2-cent rate about 30 kw.-hr. sooner on a single meter for all the house service.

SALT LAKE CITY—DENVER

Prices of electrical merchandise remain high, with little or no sign of a downward tendency. Jobbers and distributers are watching the market keenly for any intimation of a drop as a possible effect of the recent changes in price on certain commodities. So far there is nothing on which to base a forecast. The money market remains in a static condition. The scarcity of capital is seriously hampering building operations. There is little activity in the mining industry, and this condition is reflected in a lessened demand for electrical merchandise in several important lines. There is some tendency on the part of dealers to look to the Christmas trade to boost sales. Otherwise there is little change in the general market status. Consumer demand is at a low ebb in most sections.

Radiant Heaters.—The chilly weather that has prevailed during the past few days has created quite a demand. Prevailing retail prices are from $11 to $12.50.

Rigid Conduit.—Demand is healthy, but the supply is exceedingly low. An embargo at the Eastern factories affecting particularly the Intermountain region has created a serious scarcity. The embargo was called off for two weeks following the freight-rate increase, but for some reason it is now in force again.

Porcelain.—Stocks are low. Jobbers cannot begin to meet the demand. It is reported that several manufactures of sockets, receptacles, and switches have purchased their own porcelain factories. Distributers in this section expect relief as a result of this emergency measure.

Line Material.—Stocks are low in spite of the little building now in progress.

Lamp Cord.—One of the largest jobbers in the intermountain region is not promising delivery under ten months.

Hollow Ware.—Little activity is shown, though this is normally the beginning of the fall season. From now up to Christmas consumer demand is expected to increase. Stocks are generally plentiful. A scarcity is noted in the cheaper grades of percolators.

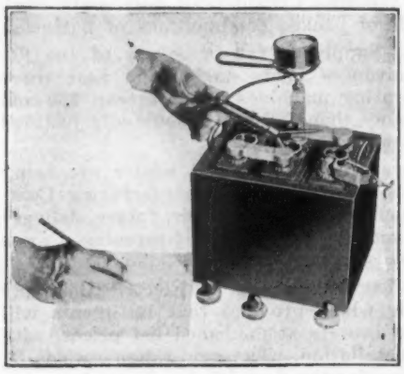
Cable.—Deliveries are requiring from four to five months.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Volt Reader for Testing Batteries

The principal uses of the "Cadmovolt" reader, brought out by the Service Station Supply Company, 30 East



DETERMINES CONDITION OF BATTERY PLATES

Larned Street, Chicago, are: Voltage test of cells on charge or discharge, cadmium test to determine the state of charge of either or both groups of positive and negative plates, and polarity test to insure proper assembly and direction of charging current. The instrument has two reading scales, one for cadmium and another for voltage. No readjustments are necessary when changing from one test to the other.

Farm-Lighting Unit

The removable control case, containing all the electric control and safety appliances, is the distinctive feature of

COMPLETELY INCLOSED AUTOMATIC FARM-LIGHTING UNIT

the lighting and power unit manufactured by the Linderman Steel & Machine Company, Dayton, Ohio. Three types of the unit are made, each of 1 kw. capacity. In the 32-volt semi-automatic model the engine is started by pressing a button and stops when the batteries are charged. In the full-automatic model the engine starts and stops automatically. The 110-volt full-automatic unit has no storage batteries. Power is generated only as needed, the turning on of a light or power switch starting the engine automatically.

Bus Switch Has Removable Insulator

To enable quick replacement of a defective or broken insulator, the Delta Star Electric Company, Chicago, has designed an easily assembled bus-type disconnecting switch. By inserting a wrench in the opening of each end block the holding bolts can be backed off, the insulator removed and a new one quickly inserted. This is accomplished without removing the switch proper from the bus structure.

Plug Fuse

A plug fuse equipped with a zinc cap to avoid the use of brass or aluminum has been developed by the Killark Electric Manufacturing Company,

METAL PARTS ARE SPUN ONTO THE PORCELAIN

3940 Easton Avenue, St. Louis, Mo. Contact is made between the friable element and the shell in the porcelain.

Notes on Recent Appliances

Rheostat for Wireless

A radio rheostat has been brought out by the Clapp-Eastham Company, Cambridge, Mass.

Lamp Socket

A socket which keeps lighted after the switch is turned off has been developed by the Lite-a-While Socket Company, Minneapolis, Minn.

Refrigerating Unit for Home Use

The Balsa Refrigerator Corporation, 149 West Thirty-sixth Street, New York City, successor to the Frigidor Corporation, is offering a self-contained refrigerator unit for home use, known as the "Frigidor."

Unit Light and Power Plant for Farm Use

As a supplement to its 1,200-watt plants, the Perfection Storage Battery Company, Fortieth St. and Rhodes Ave., Chicago, has developed its model "SAR" 1.5-kw. plant, designed to operate a milking machine or other heavy power-consuming device which would overload the ordinary plant. The engine develops 4 hp. and the plant is designed to carry seventy 16-cp. lights.

Changes in Mazda Lamps

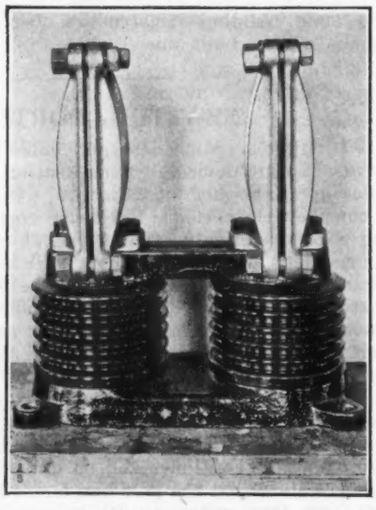
Changes in the bulb construction of certain Mazda lamps are announced by the Edison Lamp Works of Gen-

NEW TYPE BULB

eral Electric Company, Harrison, N. J. The 23-watt S-19 street railway lamp will be superseded by an S-17 bulb, which is a smaller type. The diameter of the old bulb is 2⅜ in. and the over-all height 5¼ in., while the new type is 2⅛ in. in diameter and 4⅞ in. in height.

Heavy-Duty Bus Support

Two porcelain insulators used on a single cast-iron base to carry the extra loads involved in heavy buses are the feature of a new unit bus support brought out by the Lewis & Roth Cor-



ARRANGEMENT OF CLAMPS FOR VERTICAL BUSBARS FOR ALTERNATING CURRENT

poration, Philadelphia. Different forms of clamps are made for holding horizontal or vertical arrangements of busbars.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE VARNEY ELECTRIC COMPANY store, First Street, Evansville, Ind., was damaged by fire Aug. 18. The flames spread to the three-story building adjoining occupied by the Andrew Jackson Company as a factory. Both buildings were partly destroyed and smoke and water did considerable damage to the stocks. The total loss of both companies is approximately $75,000.

THE INTERNATIONAL ELECTRIC COMPANY, Indianapolis, Ind., has obtained a ten-year lease on a large five-story block at 217-219 McCrea Street, Indianapolis. After the building is remodeled the company will remove there from its present location in the Century Building. The new building will increase the floor space to five times the former area. Young Moore is general manager.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, Mansfield, Ohio, has started on a building program which will double its plant capacity. A five-year development program of the company contemplates the erection of ten modern factory buildings, and twenty-four acres of land has been purchased for this purpose. The foundations are already in for building No. 2, which will be a machine shop, 160 ft. x 425 ft. As soon as this is finished it is planned to proceed with the other buildings.

THE W.H.S. MANUFACTURING COMPANY, Indianapolis, Ind., recently incorporated with a capital stock of $300,000 by Clyde E. Walling, John H. Higgins and W. H. Sippel, is planning the construction of a plant in Indianapolis to manufacture electrical devices.

RALPH J. PATTERSON, formerly commercial manager Twin-State Gas & Electric Company, Boston, Mass., has been appointed commercial representative of the Walker & Pratt Manufacturing Company, Watertown, Mass., with special responsibilities in electric range development work. Mr. Patterson was earlier with the Central Maine Power Company, where he conducted development work in the design of water-heating equipment.

A. A. LOEFFLER has recently been appointed by the Doehler Die-Casting Company, Brooklyn, N. Y., as its Detroit representative, succeeding F. C. Seeger, who will now represent the company on the Pacific Coast, with headquarters in San Francisco.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, has removed its Salt Lake City office to 59 West Broadway and opened a service station at that address. The branch is in charge of L. Brandenburger.

THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, announces a change in its corporate name to the "Conveyors' Corporation of America." The company manufactures steam-jet conveyors, trolley carriers, bearing sheaves and other conveyor supplies. A large and completely equipped machine shop, to which foundry facilities will be added, has been acquired at South Bend, Ind.

THE NATIONAL LAMP WORKS of General Electric Company, Nela Park, Cleveland, Ohio, held a conference of jobbers' representatives at Nela Park on Sept. 13, 14 and 15 to study proper industrial lighting methods. The National Lamp Works is holding its second yearly contest between factories in an effort to increase production and eliminate "shrinkage." The contest, which is distinct for the large and miniature lamp divisions, is called the "ballot-box battle" and will last through September, October and November. Each factory will be known by the name of a state. The factory managers become candidates for "president of the lamp states" and are credited bi-monthly with a certain number of votes based on their factory's showing in production and shrinkage. The system is carried down through the organization, which is divided into two "political parties." Minor contests are held for "mayor," "governor," etc.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York, announces the appointment of the Mountain States Machinery Company, 1710 Glenarm Street, Denver, Col., as its agent in the states of Colorado, Wyoming and New Mexico. The Mountain States Machinery Company (successors to the Vaughan Machinery Company) will handle, in addition to the Roller-Smith lines, the products of many other important concerns, such as the Crocker-Wheeler Company, Maloney Electric Company, Cutler-Hammer Manufacturing Company and Terry Steam Turbine Company.

THE M. B. AUSTIN COMPANY, 700 Jackson Boulevard, Chicago, Ill., has a new building under construction at 108 South Desplaines Street, Chicago, to cost with site, $250,000. The building will be three stories in height and have a floor space of 30,000 sq.ft.

AMERICAN MANUFACTURERS' EXPORT ASSOCIATION TO MEET. — The eleventh annual convention of the American Manufacturers' Export Association will be held at the Waldorf-Astoria, New York, Thursday, Oct. 14. The convention will be limited to a one day's session. The theme of the convention will be the part American manufacturers must take to secure permanent world trade.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, announces that with the expiration of Emerson motor fan contracts this month all prices quoted have been withdrawn and that new prices will not be available for about sixty days.

THE R. H. BEAUMONT COMPANY, 319 Arch Street, Philadelphia, has recently opened an office at 230 Fifth Avenue, Pittsburgh, which will be in charge of Thomas Widdaps.

Supply Jobbers' Notes

THE REPUBLIC ELECTRIC COMPANY, Davenport, Iowa, has installed a $100,000 stock in its headquarters, 120 East Front Street, and expects to cover a large field in this territory. It handles electrical appliances of all kinds. J. S. Kimmel is president, A. M. Butler secretary-treasurer and T. H. Harris general manager.

Foreign Trade Notes

ELECTRICAL HOUSEBOAT TO MAKE AN EDUCATIONAL TOUR THROUGH CHINA.—The Western Electric Company is to take the electrical idea to the millions of Chinese by means of a houseboat containing all of the latest labor-saving devices now found in American homes. This boat will begin touring the rivers and canals of China this winter and will emphasize the value of farm-light plants. The boat is scheduled to make a trip of about 5,000 miles in a territory populated by more than a hundred million Chinese, most of whom are absolute strangers to anything electrical. It will carry a complete line of household devices, including motor-driven sewing machines, vacuum cleaners, irons, washing machines and the labor-saving electrical apparatus which American farmers are now using. A staff of expert demonstrators will make the trip and show how easily electricity may be introduced locally by means of the farm-light plants. With the introduction of local lighting plants one of China's greatst handicaps in the way of study and development will be relieved. It is realized that only the wealthier classes will be able to purchase the electrical apparatus, but the great number of retainers on their estates should profit indirectly. Western Electric representatives report that since their introduction in 1917 there has been an altogether unexpected demand for electrical sewing machines and flatirons from the natives of Canton, Shanghai and the other coastal towns. Washing machines and also all of the other larger types of electrical apparatus are also coming into favor.

HOLLAND INDUSTRIES FAIR. — The fifth industries fair to be held in Utrecht, Holland, Sept. 6-16, 1921, will be of international character as all foreign manufactures and products will be admitted. The general secretary is at Vredenburg, Utrecht.

JOBBERS' REPRESENTATIVES CONFERENCE, NELA PARK

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Italy (No. 33,747) desires to purchase and secure an agency for electric fixtures.

An importer in Holland (No. 33,753) desires to secure an agency for electrical fittings.

A firm in France (No. 33,756) desires to secure an agency for electrical equipment and motors.

A firm of electrical machinery dealers in The Netherlands (No. 33,757) desires to purchase small three-phase, 220-volt, alternating-current motors.

Trade Publications

ARC WELDING.—The Ohio Brass Company, Mansfield, Ohio, has issued a booklet covering equipment and instructions for electric arc welding.

SINGLE-PHASE CONSTANT-SPEED MOTORS.—The Advance Electric Company, St. Louis, Mo., is distributing bulletin No. 16, describing its type WS single-phase, constant-speed interchangeable, 110-volt or 220-volt motors, rated from ½ hp. to 7½ hp..

STORAGE BATTERIES. — The Electric Storage Battery Company, Philadelphia, has issued bulletin No. 179, to describe its new type of storage batteries for mine and industrial locomotives.

LAMP HANGERS.—The Thompson Electric Company, 226 St. Clair Avenue, Cleveland, Ohio, has issued a bulletin covering its safety disconnecting hanger for incandescent lamps.

STEEL-MILL CONTROL.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a new illustrated booklet describing its line of steel-mill control apparatus.

FUSES. — The Efficiency Electric Company, East Palestine, Ohio, has issued a leaflet describing its line of refillable plug fuses.

ELECTRICAL SPECIALTIES. — The Anderson Electric & Equipment Company, 154 Whiting Street, Chicago, has issued a complete catalog No. 3, covering electric lighting, automotive, laboratory and dental apparatus.

FACTORY CALLING SYSTEM. — The Klaxon Company, Bloomfield, N. J., has issued a new catalog on its "Klaxocater" factory calling system.

MILL DRIVES. — The General Electric Company, Schenectady, N. Y., has issued bulletin No. 41,000 C, to supersede No. 41,000 B. It covers main roll drives for steel, copper and similar mills.

MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued motor price and data book No. 50.

New Incorporations

THE L. BRUN COMPANY, Cleveland, Ohio, has been incorporated by Louis Brun, Charles D. Benson, Jr., Clarence N. Gilles and M. Giore. The company is capitalized at $25,000 and proposes to manufacture and deal in all kinds of electrical fixtures and appliances.

THE GIANT BATTERY COMPANY, Commercial Bank Building, Houston, Tex., has been incorporated with a capital stock of $22,000 to manufacture storage batteries. The officers are: C. C. Rouse, president; Ralph Neuhaus, treasurer, and L. S. Holmes, manager.

THE BAILEY ELECTRIC SUPPLY COMPANY, New York City, has been chartered with a capital stock of $250,000 by H. Hammersly, H. Rothstein and L. D. Bailey, 1025 East Sixteenth Street, Brooklyn, N. Y.

THE ACKURATE RUBBER COMPANY, INC., 253 Broadway, New York, has been incorporated to manufacture insulating tapes, compounds and like specialties. Willard C. Candee is president and C. V. Ackerman secretary and treasurer.

THE SOMERVILLE (TEX.) LIGHT, WATER & ICE COMPANY has been incorporated with a capital stock of $50,000. The incorporators are Hugh Hamilton, R. W. Harlock and Paul Freeman.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

POULTNEY, VT.—The S. S. Sherman Milling Company contemplates immediate installation of equipment for electric operation of its entire plant. Electric power will be supplied by the Vermont Hydro-Electric Company.

CHELSEA, MASS.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until October 6 for alterations and additions to the lighting system at the Naval Hospital.

Middle Atlantic States

MARCY, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until October 6 for electric generator set and underground electric service connections at the Utica State Hospital (Marcy Division).

ROOSEVELT, N. Y.—At a special meeting of the Town Board a resolution was passed providing for a change from gas to electric street lights.

TROY, N. Y.—The Ford Motor Company, Boulevard and Woodward Street, Detroit, Mich., contemplates the erection of a power house on Green Island, to develop 6,000 hp., at a cost of $2,000,000. Stone & Webster, 120 Broadway, New York City, are engineers.

NEWARK, N. J.—The erection of a new power house and automobile service building at the chemical works of Riches-Piver & Company, 226 Hillside Avenue, Hillside, in connection with a factory extension, is contemplated. The capital stock of the company was recently increased from $125,000 to $500,000.

NEWARK, N. J. — The erection of a power plant at the works of the American Brake & Shoe Company, Avenue R, is contemplated. The cost is estimated at about $25,000.

NEWARK, N. J.—The Amalgamated Dye Stuff & Chemical Company plans to erect a new power house at its plant on Plum Point Lane.

ALLENTOWN, PA. — Bids will be received by Malcolm W. Cross, Mayor, Room 301, Central Fire and Police Station, until October 11 for furnishing and installing one 750-hp. steam turbine with reduction gears, one 12,000,000-gal. centrifugal pumping unit, one 500-hp. alternating current motor, one three-stage, 7,000,000-gal. pump, etc.

FRANKLIN, PA.—The Franklin Quality Refining Company, Atlantic Avenue and Erie Railroad Street, contemplates the erection of a power house to cost about $80,000.

JUNIATA, PA.—The McAllisterville Electric Company of McAllisterville, recently organized, has applied for state charter and permission to establish and operate an electric plant in certain districts of Juniata County.

PHILADELPHIA, PA. — The Wilkes-Barre Light Company is to be reorganized. It is planned by the new company to dispose of the present machinery at its plant and install new equipment to furnish 3,000 kw.

PHILADELPHIA, PA.—Plans are under way for the erection of a power house for the Carver File Company, 3231 Frankford Street.

RIDDLESBURG, PA. — The Broad Top Power Company, it is understood, contemplates the erection of a power plant to cost about $600,000.

BALTIMORE, MD.—It is reported that the Consolidated Gas, Electric Light & Power Company of Baltimore will soon receive bids for the construction of the first unit of its proposed power plant at Dundalk.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until October 6 for underground electric light and power distributing system. For further information address above. (Specification 4286.)

WASHINGTON, D.C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, until October 15 for the erection of a power house, 69 ft. x 81 ft., together with several other buildings, at the Bellevue Naval Experimental and Research Laboratory.

North Central States

LEBANON, IND. — The Indestructible Wheel Company contemplates the erection of a power house in connection with its proposed new plant to cost about $50,000.

NEWBURG, IND.—The county commissioners have granted a franchise to the Newburg Light & Water Company of Newburg to extend its lines to the Epworth Coal Mine.

KANSAS CITY, MO.—The Kansas City Power & Light Company is having estimates prepared, preliminary to financing additions to its plant and lines. Plans include the sinking of a condenser well and enlargement of the building proper to provide for a 20,000-kw. or possibly a 30,000-kw. turbo-generator, for which $2,500,000 will be required. An additional $2,000,000 will be required for extensions of the existing transmission systems to be made next year. J. F. Porter is president.

ST. LOUIS, MO.—The erection of an engine and power house to cost about $30,000 is contemplated by the Gerst Brothers Packing Company, 3823 Lucky Street.

KINDRED, N. D.—At a special election bonds to the amount of $15,000 were voted for the erection of an electric light plant in this city.

MAYVILLE, N. D.—The erection of a power plant in Mayville to cost about $20,000 is contemplated. Owner's name is withheld. Arthur Devor, 486 Endicott Building, St. Paul, Minn., is architect.

HIGHMORE, S. D.—The matter of making extensive improvements to the municipal electric light and power plant is under consideration by the City Council.

McCUNE, KAN.—The city officials contemplate the erection of two miles of 66,000-volt transmission lines for the municipal light plant.

OSAWATOMIE, KAN.—Plans are under way by the Black & Veatch Engineering Company, Mutual Building, Kansas City, Mo., for the erection of an addition to the municipal electric light and power plants. Improvements include the installation of a generating unit, construction of a dam, etc. Estimated cost is $85,000.

WICHITA, KAN. — Arrangements have been completed to provide electric lights and power for Goddard and Garden Plain, and permission has been granted by the board of county commissioners for the construction of high-tension lines from Wichita to the two towns.

Southern States

GAINESVILLE, FLA.—Improvements to the electric light and water plants are contemplated at a cost of about $30,000. Plans include the installation of an engine and generator, switchboard and accessories, motor-generating set, etc.

BIRMINGHAM, ALA.—The Corona Coal Company contemplates the installation of a 200-kva. rotary converter and a 100-hp. hoist, also the erection of an 8-mile, 13,000-volt transmission line. L. M. Adler is general manager.

ANDERSON, ARK.—The National Manganese Ore Company, 1009 Fletcher Build-

ing, Indianapolis, Ind., contemplates the erection of a hydro-electric plant across Lafferty Creek to develop 100 hp. The cost is estimated at $60,000.

EL DORADO, ARK.—Petition has been made to the City Council by S. R. Morgan & Company, Little Rock, for permission to erect an electric power line from its plant at Cargile to the El Dorado Ice & Coal Company, which is owned by Morgan interests.

BRADFORD, OKLA. — The installation of an electric light plant is contemplated. Address W. H. Hayes.

TULSA, OKLA. — The Sand Springs Light, Heat & Power Company contemplates the erection of a 10-mile high-tension transmission line from the Sand Springs power house to Tulsa. Charles Page, at Sand Springs, is president.

DALLAS, TEX.—Bids will soon be received by Herbert M. Greene Company, architect, North Texas Building, for the erection of a twelve story office building for the Security National Bank, Commonwealth Building, and an eight story addition on the existing building, to cost about $1,000,000. Plans include an individual power plant.

DICKINSON, TEX.—The installation of a lighting system in Dickinson is contemplated.

MORAN, TEX. — The Albany Light & Stone Quarry Company of Albany plans to extend its power transmission line to Moran and install a lighting system at that place. Arrangements are also being made for the erection of waterworks to cost about $90,000.

SAN ANGELO, TEX.—The San Angelo Water, Light & Power Company plans to install additional equipment at its plant at this place. Improvements to its power transmission system to Miles, Rowena, Ballinger and Winters are also contemplated.

Pacific and Mountain States

BURNS, ORE.—Louis C. Kelsey, consulting engineer, 22½ North Twentieth Street, Portland, has submitted to the City Council estimates which call for $300,000 for the erection of the proposed municipal light and water plant.

PORTLAND, ORE. — The Eastern & Western Lumber Company, foot of Twenty-first Street, North, has plans under way for the erection of a power plant to cost about $25,000.

MERCED, CAL.—The construction of an electric plant on Chowchilla Road near Merced is being planned for by the San Joaquin Light & Power Corporation of Fresno at a cost of about $100,000.

SACRAMENTO, CAL.—Improvements to the lighting system in the business district of Oak Park are under consideration. Carl Beaton is city electrician.

TERRA BELLA, CAL. — Plans for the purchase of electrically operated pumping machinery, motors, etc., for installation at the new wells to be established in the Terra Bella Irrigation District have been approved by the board of directors.

OGDEN, UTAH.—The Utah Power & Light Company contemplates the extension of light system to the city of Morgan.

PROVO, UTAH.—A new company, to be known as the Goshen Bay Irrigation Company, is being organized for irrigation and drainage purposes. Plans include the installation of electrically operated pumping plants and drainage systems.

ROUNDUP, MONT. — The City Council has voted to issue $56,000 in bonds for improvements including ornamental street-lighting system.

DENVER, COL.—According to information received by Walter B. Lowry, manager of improvements and parks, additions to the ornamental street-lighting system, to cost about $20,000, are under consideration by business men and property owners.

Canada

GRAND FALLS, N. B. — The New Brunswick Electric Power Commission proposes to construct a large power plant at Grand Falls, in addition to the power developments at Shogomoc and Musquash. C. O. Foss of St. John is chief engineer.

VYONDA, SASK. — The Town Council contemplates the erection of an electric light plant to cost about $12,000. J. Currie is secretary and treasurer.

Miscellaneous

PANAMA.—Bids will be received at the office of the General Purchasing Officer, Panama Canal, Washington, D. C., until October 12 for furnishing copper cable, conduits, switchboard cords, fuse cutouts, renewable fuses, motors, motor-generator sets, panelboards, etc. (Circular 1407.)

1,342,398. ELECTRODE FOR SEARCHLIGHTS AND METHODS OF MAKING THE SAME; Elmer A. Sperry, Brooklyn, N. Y. App. filed July 15, 1916. Core and shell baked simultaneously.

1,342,399. WIRELESS SIGNALING APPARATUS; Roy A. Weagant, Roselle, N. J. App. filed Feb. 1, 1916. For receiving, relaying or amplifying impulses.

1,342,409. STARTING AND GENERATING SYSTEM; William A. Turbayne, Niagara Falls, N. Y. App. filed April 11, 1918. Automobile storage-battery starter.

1,349,391. CONTROL SYSTEM FOR ELECTRIC FURNACES; Frank Thornton, Jr., Mansfield, Ohio. App. filed March 19, 1919. Changes transformer taps.

1,349,400. BELL-RINGING MECHANISM; Herman A. Wende, Buffalo, N. Y. App. filed June 22, 1914. For operating chimes.

1,349,405. ELECTRIC-TRAIN WIRE COUPLING; Thomas R Brown, Sparkill, N. Y. App. filed March 6, 1917. Rotary motion produced for cleaning contacts.

1,349,483. LAMP FIXTURE; Frank Yokel, Pittsburgh, Pa. App. filed Feb. 19, 1917. Simple design.

1,352,408. COMMUTATOR BRUSH; William C. Hood, Chicago, Ill. App. filed Oct. 28, 1918. Has wiping action across commutator.

(Issued Sept. 21, 1920)

14,950 (reissue). ELECTRICAL SWITCH DEVICE; William F. Hessel, New York, N. Y. App. filed March 11, 1919. Plug for extension lights.

1,353,145. DEVICE FOR VARYING ELECTRICAL COUPLING; Lewis M. Clement, Newark, N. J. App. filed June 20, 1918. Radio.

1,353,154. BATTERY-PLATE SUPPORT; Edward M. Duffey, Kansas City, Mo. App. filed April 12, 1920. For securely attaching plate.

1,353,185. ELECTRICAL SWITCHING SYSTEM; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Sept. 6, 1918. Electrolytic.

1,353,194. ELECTROLYTIC APPARATUS; Cecil M. Walter, Four Oaks, Birmingham, England. App. filed June 12, 1919. For treatment of tinned articles.

1,353,257. ELECTRIC COMBINATION LOCK; Adolph Z. Mample, St. Paul, Minn. App. filed Aug. 29, 1919. For automobiles. etc.

1,353,269 WINDING MACHINE; Philip F. Rhoades, New York, N. Y. App. filed May 3, 1919. For coil winding.

1,353,300. SEMI-AUTOMATIC TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed July 25, 1917. Improvements.

Record of Electrical Patents

Notes on United States Patents

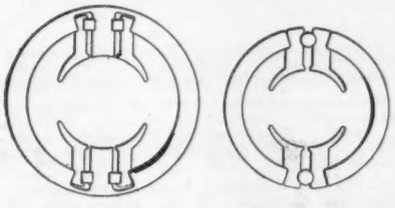
1,353,319. ELECTRIC REGULATION; John L. Creveling, White Plains, New York. App. filed Nov. 1, 1916. To regulate generator automatically.

1,353,332. FILLING APPARATUS FOR ELECTROLYTIC CELLS; Joseph H. Fischer, Milwaukee, Wis. App. filed Dec. 8, 1919. For producing oxygen.

1,353,348. PORTABLE HAND LAMP; Harry M. Koretzky, Brooklyn, N. Y. App. filed June 18, 1919. New reflector and socket.

1,353,401. CONTROLLING MEANS FOR ELECTROMAGNETIC FEED-REEL BRAKES; Henry V. James, Radlett, England. App. filed Aug. 13. 1918. For printing presses, etc.

1,353,410. SUBMARINE DETECTOR; George M. Marshall, Lake Francis, Manitoba, Canada. App. filed Jan. 3, 1918. Audible or visible signal.



No. 1,353,658. Dynamo-Electric Machine

1,353,433. MULTI-SOCKET SWITCH; Raymond D. Smith, Boston, Mass. App. filed Oct. 27, 1916. Accommodates plurality of plugs.

1,353,464. TELEGRAPH REPEATING SYSTEM; Augustus J. Eaves, New York, N. Y. App. filed Nov. 12, 1919. Half-duplex methods.

1,353,471. ELECTRIC IRON; Joseph A. Guyer, Marion, Ind. App. filed March 24, 1919. Readily taken apart.

1,353,517. IMPULSE-CONTROLLING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 19, 1918. Automatic telephone.

1,353,566. SAFETY SPARK GAP FOR MAGNETOS; Alfred C. De Lorme, East Orange, N. J. App. filed Dec. 1, 1916. Adjustable.

1,353,597. SPARK PLUG; Donald W. Lang, and Arthur D. Vaughn, Eldred, Pa. App. filed May 19, 1919. Adjustable gap.

1,353,601. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Dec. 27, 1918. Automatic.

1,353,612. TELEPHONE-EXCHANGE SYSTEM; Frank N. Reeves, Newark, N. J. App. filed Sept. 30, 1918. Automatic.

1,353,637. REPEATER CIRCUIT; George Crisson, Hoboken, N. J. App. filed Dec. 23, 1918. For telephones.

1,353,657. SPARK-PLUG INTENSIFIER; Richard E. Hildebrans, Chicago, Ill. App. filed Jan. 29, 1917. Auxiliary gap.

1,353,658. DYNAMO-ELECTRIC MACHINE; Jaroslaw K. Kostko, St. Louis, Mo. App. filed Dec. 18, 1916. Laminated yoke and poles.

1,353,665. TEMPERATURE CONTROLLER; Albert N. Otis, Schenectady, N. Y. App. filed July 18, 1918. For melting pots.

1,353,673. AUTOMATIC TELEPHONE SYSTEM; Henry Symes, Dunedin, New Zealand. App. filed Nov. 9, 1916. Coin and subscriber system.

1,353,684. WELDING MACHINE; Robert E. Wagner and Wesley E. Laird, Pittsfield, Mass. App. filed April 9, 1919. Has long stroke.

1,353,690. ELECTRIC PLUG; Arthur Aguere, West Somerville, Mass. App. filed Nov. 3, 1919. Non-screwing.

1,353,691. VOLTAGE REGULATOR FOR ALTERNATING-CURRENT GENERATORS; Fred H. Winter, Schenectady, N. Y. App. filed March 1, 1919. To deliver current at different frequencies to induction motors.

1,353,693. MAGNETIC DEFLECTOR FOR ELECTRIC ARCS IN LAMPS, SEARCHLIGHTS AND THE LIKE; John P. Yorke, Westminster, London, England. App. filed June 25, 1918. Maintains arc position.

1,353,698. COMBINED CARRIER AND RADIO SYSTEM; Herman A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. Plurality of signals simultaneously transmitted.

1,353,711. ELECTRIC WELDING AND REACTOR; Sven R. Bergman, Nahant, Mass. App. filed June 25, 1920. Adjustable current.

1,353,735. ANTENNA STRUCTURE; Lloyd Espenschield, Hollis, N. Y. App. filed Sept. 26, 1919. Broad band filter.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. B. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10, 1921.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 11-15.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. Thirty-ninth Street, New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City. Annual meeting, New London, Conn., Sept. 13-16.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill. Annual meeting, Chicago, Ill., Oct. 28-31.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Vancouver, B. C., Oct. 19.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Annual meeting, Columbus, Ohio, Oct. 6.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City. Annual convention, Utica, N. Y., Oct. 7-8.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Cleveland, Oct. 4-7.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, New Orleans, La., Oct. 19-22.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 4-9.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass. Annual meeting, Philadelphia, Pa., Oct. 12-13.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis, Minn.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 Fifth Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Miami, Fla., Nov. 17-19.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual convention, Detroit, Mich., Jan. 25-27, 1921.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Bldg., Milwaukee, Wis.